

SDMS Document ID



966433

402784

GROUNDWATER AND SURFACE WATER STUDY REPORT

SILVER CREEK TAILING SITE  
SUMMIT COUNTY, UTAH  
EPA ID# 980851404

Prepared by  
The Utah Department of Health  
In Cooperation With  
U.S. Geological Survey

GROUNDWATER AND SURFACE WATER STUDY REPORT

SILVER CREEK TAILING SITE  
SUMMIT COUNTY, UTAH  
EPA ID# 980851404

Prepared by  
The Utah Department of Health  
In Cooperation With  
U.S. Geological Survey

## TABLE OF CONTENTS

	PAGE
<b>LIST OF TABLES AND FIGURES . . . . .</b>	<b>ii</b>
<b>1.0 INTRODUCTION . . . . .</b>	<b>1</b>
<b>2.0 PROJECT OBJECTIVE . . . . .</b>	<b>2</b>
<b>3.0 SITE DESCRIPTION . . . . .</b>	<b>2</b>
<b>3.1 Site Location and History . . . . .</b>	<b>2</b>
<b>3.2 Description of Study Area . . . . .</b>	<b>4</b>
<b>3.2.1 Physiography . . . . .</b>	<b>4</b>
<b>3.2.2 Geology . . . . .</b>	<b>4</b>
<b>3.3 Surface Water Hydrology . . . . .</b>	<b>4</b>
<b>3.4 Groundwater Hydrology . . . . .</b>	<b>5</b>
<b>3.4.1 Water in Unconsolidated Valley Fill . . . . .</b>	<b>5</b>
<b>3.4.1.1 Recharge . . . . .</b>	<b>6</b>
<b>3.4.1.2 Movement . . . . .</b>	<b>6</b>
<b>3.4.1.3 Discharge . . . . .</b>	<b>6</b>
<b>3.4.1.4 Seasonal Water Fluctuations . . . . .</b>	<b>7</b>
<b>3.4.1.5 Hydraulic Properties . . . . .</b>	<b>8</b>
<b>3.4.2 Water in Consolidated Rocks . . . . .</b>	<b>8</b>
<b>3.4.2.1 Recharge . . . . .</b>	<b>9</b>
<b>3.4.2.2 Movement . . . . .</b>	<b>9</b>
<b>3.4.2.3 Discharge . . . . .</b>	<b>10</b>
<b>3.4.2.4 Seasonal Water Level Fluctuations . . . . .</b>	<b>10</b>
<b>3.4.2.5 Hydraulic Properties . . . . .</b>	<b>10</b>
<b>4.0 FIELD ACTIVITIES . . . . .</b>	<b>10</b>
<b>4.1 Drilling . . . . .</b>	<b>10</b>
<b>4.2 Slug Tests . . . . .</b>	<b>11</b>
<b>4.3 Sample Collection . . . . .</b>	<b>11</b>
<b>4.3.1 Groundwater Samples . . . . .</b>	<b>11</b>
<b>4.3.2 Surface Water/Sediment Samples . . . . .</b>	<b>12</b>
<b>4.3.3 Tailings Characterization . . . . .</b>	<b>12</b>
<b>5.0 AQUIFER INTERFERENCE TESTS . . . . .</b>	<b>13</b>
<b>6.0 ANALYTICAL RESULTS . . . . .</b>	<b>14</b>
<b>7.0 QUALITY ASSURANCE . . . . .</b>	<b>15</b>
<b>7.1 Groundwater Route . . . . .</b>	<b>15</b>
<b>7.1.1 Round I . . . . .</b>	<b>15</b>
<b>7.1.2 Round II . . . . .</b>	<b>15</b>
<b>7.1.3 Round III . . . . .</b>	<b>15</b>
<b>7.1.4 Round IV . . . . .</b>	<b>16</b>
<b>7.2 Surface Water Route . . . . .</b>	<b>16</b>
<b>8.0 DISCUSSION OF ANALYTICAL RESULTS . . . . .</b>	<b>16</b>
<b>8.1 Waste Characterization . . . . .</b>	<b>16</b>
<b>8.2 Groundwater Data . . . . .</b>	<b>16</b>
<b>8.3 Statistical Evaluation . . . . .</b>	<b>18</b>
<b>8.4 Surface Water/Sediment Data . . . . .</b>	<b>19</b>
<b>9.0 TARGETS . . . . .</b>	<b>20</b>
<b>9.1 Groundwater . . . . .</b>	<b>20</b>
<b>9.2 Surface Water Route . . . . .</b>	<b>20</b>
<b>10.0 CONCLUSIONS . . . . .</b>	<b>20</b>
<b>10.1 Tailings Characterization . . . . .</b>	<b>21</b>
<b>10.2 Groundwater . . . . .</b>	<b>21</b>
<b>10.3 Surface Water . . . . .</b>	<b>22</b>
<b>11.0 RECOMMENDATIONS . . . . .</b>	<b>23</b>
<b>REFERENCES - ACKNOWLEDGEMENT . . . . .</b>	<b>24</b>
<b>6880U/8</b>	

## LIST OF TABLES

TABLE 1	Selected Monitoring Well Data . . . . .	T-1
TABLE 2	Lithologic Logs of Monitoring Wells . . . . .	T-2
TABLE 3	Water Levels in Observation Wells . . . . .	T-7
TABLE 4	Estimated Values of Hydraulic Conductivity . . . . .	T-13
TABLE 5	Field Parameters for Surface Water Sites . . . . .	T-14
TABLE 6	Surface Water Filtered Samples . . . . .	T-15
TABLE 7	Surface Water Unfiltered Samples . . . . .	T-17
TABLE 8	Sediment Samples Analyses . . . . .	T-19
TABLE 9	Groundwater Samples Analyses . . . . .	T-20
TABLE 10	Tailings Samples . . . . .	T-31
TABLE 11	Statistical Evaluation . . . . .	T-32

## LIST OF FIGURES

FIGURE 1	Location of Study Area . . . . .	F-1
FIGURE 2a	Data Collection Sites - for groundwater . . . . .	F-2
FIGURE 2b	Data Collection Sites for Surface water . . . . .	F-2b
FIGURE 3	Geology of Prospector Square Area - for surface water . . . . .	F-3
FIGURE 4	Potentiometric Surface In Shallow Unconsolidated Valley-Fill Aquifer	F-5
FIGURE 5	Seasonal Variation . . . . .	F-6
FIGURE 6	USGS Topographic Map . . . . .	F-13
FIGURE 7	Trilinear Diagram . . . . .	F-14

## ATTACHMENTS

ATTACHMENT A	Drilling Report
ATTACHMENT B	Field Audit Report
ATTACHMENT C	Modifications to Work Plan
ATTACHMENT D	Outline for Student T-Test
ATTACHMENT E	Interference Test Data
ATTACHMENT F	Response to Comments
ATTACHMENT G	E.P. Toxicity Data
ATTACHMENT H	Sampling Data
ATTACHMENT I	Data Validation and Lab. Quality Control Reports

## 1.0 INTRODUCTION

In September of 1985, the Silver Creek Tailings site (also known as "Prospector's Square" and "Park City") was nominated by EPA for inclusion on the Superfund National Priorities List. The Superfund law expired in late 1985 and reauthorization of the program was delayed until October 17, 1986. During this period, no final National Priorities List decision was made by EPA on the Silver Creek Tailings nomination and no follow-up field work or work plan development occurred.

On October 17, 1986, the Silver Creek Tailings site was removed from its status as a proposed site on the National Priorities List pursuant to Section 118 (p) of the Superfund Amendments and Reauthorization Act of 1986 (SARA). The site was deemed removed from the NPL unless EPA determined that a potential threat to the public, welfare or the environment exists at the site. Section 118 (p) of SARA specified that such a determination shall be based "upon site specific data not used in the (previous) proposed listing of such facility". Pursuant to the passage of SARA, the U.S. Environmental Protection Agency, the State of Utah and Park City Municipal Corporation signed a Site Investigation Agreement for an expanded site investigation of the Silver Creek Tailings Site, Park City, Utah in July 1987.

This agreement between Park City, the State of Utah (STATE) and the United States Environmental Protection Agency Region VIII (EPA) establishes the roles and responsibilities, of these respective agencies (the "Participants") in completing an expanded site investigation and health assessment of the Silver Creek Tailings site in Park City, Utah. The purpose of the Site Investigation and health assessment is to determine if any releases of contaminants from the tailings at the site pose a threat to human health or the environment.

Specifically the study included:

1. Environmental sampling to determine whether contaminants are being released from the tailings through the air for ingestion, through the surface water to Silver Creek, or through the soils/groundwater to the shallow or deep aquifers underlying the site; and
2. A health assessment to determine whether any releases of contaminants from the tailings through these pathways present a threat to human health. The Agency for Toxic Substances and Disease Registry has already completed this study.

All activities conducted during this site investigation were described in, and accomplished in accordance with approved work plans, sampling plans, health/safety plans, and quality assurance project plans (QAPP), collectively referred to as project plans. A detailed Work Plan for the ground water/surface investigation was prepared and approved by the participants in May 1987. Modifications to the work plan were approved by all participants. These modifications are included in Attachment C. This report summarizes the findings of the groundwater/surface water study. A separate report for the air study is also being finalized. The Utah Health Department was designated as the lead agency for this study with input from all participants: Ecology and Environment, Inc. provided

the drilling and analytical support throughout the project. The U.S. Geological Survey provided their technical expertise and conducted all field activities jointly with the Utah Health Department and EPA.

## 2.0 PROJECT OBJECTIVES

The objectives of this study were five-fold. First, to determine if hazardous substances are being released to the groundwater and or surface water. Second, to characterize the groundwater/surface water in the area by studying physical/chemical parameters and their seasonal variations. Third, to determine if there is a hydraulic interconnection between the unconsolidated valley fill and the consolidated rock aquifer. Fourth, to study the geologic/hydrologic environment of the study area. Fifth, to study the approximate depth and volume of tailings in the area and their chemical composition.

## 3.0 SITE DESCRIPTION

### 3.1 SITE LOCATION AND HISTORY

The Silver Creek Mine Tailings/Prospector Square site is located approximately 30 miles east of Salt Lake City on the eastern flank of the Wasatch Mountain Range, in the NE 1/4, Section 9, NW 1/4, Section 10, Township 2 South, Range 4 East, Salt Lake Principal Meridian; Summit County, Utah (Figure 6). The tailings are located approximately one-half mile northeast of Park City's business district, at the intersection of Highway 224 and alternate U.S. 40.

The Park City District has been the site of precious metal mining since its discovery of silver in 1869. The processing of millions of tons of ore over the decades since the first discovery has generated a large volume of mine tailings. These mine tailings have been disposed in various areas near Park City, one such area is Prospector Square, which is the subject of this investigation.

Mill tailings were first deposited on Prospector Square in the early 1900's. It is suspected that some of the tailings were slurried to Prospector Square via Silver Creek. Mill tailings were deposited at Prospector Square until the 1930's. Mine tailings derived from the milling of precious metal ore generally contain elevated levels of heavy metals including arsenic, cadmium, chromium, lead and zinc. The tailings were uncontaminated, cover approximately 80 acres, range in depth from 1 to 10 feet and have been very accessible to the inhabitants of Park City. The tailings are a potential source of contamination to the area's surface water, ground water and air environments.

In the 1940's Pacific Bridge, Inc., reworked the tailings and used solvents and acids to extract (leach out) the residual silver that had remained in the tailings after the initial milling process. Pacific Bridge used an in-situ leaching process.

In the late 1970's commercial developers started building businesses at Prospector Square. The tailings were not covered and are still exposed in undeveloped areas of Prospector Square. This area has been undergoing rapid growth in the last several years. Currently, the site is occupied by roads, residences, landscape, parking lots, or retail buildings. Approximately two acres of uncovered tailings remain. However, plans are now being developed by Park City to cover the exposed tailings. Approximately 170 single family residential structures and many multi-family units have been built or are planned.

### 3.2 DESCRIPTION OF STUDY AREA

#### 3.2.1 Physiography

The Prospector Square area lies within the Middle Rocky Mountains physiographic province (Fenneman, 1931). Altitudes range from about 6,700 feet on the valley floor to about 10,000 feet in the adjacent Wasatch Range to the southwest. The area is divided by a slight topographic high which results in two separate drainages. Most of the Prospector Square area is drained by Silver Creek which flows to the east; but, McLeod Creek, a tributary of East Canyon Creek, drains some of the northwestern part of the area and flows to the north.

#### 3.2.2 Geology

Consolidated rocks in the Prospector Square area and the surrounding mountains range in age from Pennsylvanian through Tertiary, and the overlying unconsolidated valley fill is of Quaternary age (Figure 3). The consolidated rocks which crop out or underly the unconsolidated valley fill are of sedimentary origin with sandstone, limestone, shale, and quartzite being the most prevalent. The unconsolidated valley fill is primarily composed of alluvial deposits.

The region surrounding the Prospector Square area was structurally deformed by folding and faulting. The folding has resulted in most of the consolidated rocks in the study area dipping to the north and northwest (fig. 3). Most of the deformation is related to high-angle thrust faults and has resulted in a complex geologic framework with extensive fracturing in most of the consolidated rocks. In limestone, such as the Thaynes Formation, the fractures have been enlarged by dissolution. Due to the deformation properties of each type of rock, local fracture patterns are present but no regional fracture patterns are apparent.

### 3.3 SURFACE-WATER HYDROLOGY

Sources of streamflow in the Prospector Square area are rain or melting snow, direct groundwater discharge to the stream and drains and spring discharge. Silver Creek, which flows along the southern portion of the unconsolidated valley fill, derives its flow from runoff in the mountains south of Park City. Silver Creek exits the study area through a narrow canyon on the east side and flows towards Richardson Flat (Figure 1).

Holmes, Thompson, and Enright (1986, p. 11) report an estimated average annual flow of 0.8 cubic feet per second in the upstream portion of Silver

Creek south of Park City. The annual flow through the Prospector Square area probably would not be significantly greater due to the lack of significant inflow from other drainages or springs. Immediately south of the Prospector Square area, flow in Silver Creek is largest during spring runoff and usually goes dry during the summer months.

Most of the water in the Pace-Homer Ditch is derived from groundwater sources. The Pace-Homer Ditch originates near the Park Meadows Golf Course where it collects water from a series of ponds and drains. Dority Spring, the Pace and Homer Spring areas, and at least two drains also discharge water into the ditch in this area. The Pace-Homer Ditch probably receives some direct seepage of groundwater from the unconsolidated valley fill before it joins with Silver Creek east of Prospector Square.

The flow in the Pace-Homer Ditch is measured at a two-foot Parshall flume located above the first diversion where water is allowed to enter Silver Creek. Data are collected at the flume during the summer months (May through September) and the measurements of flow are compiled in the Weber River Distribution System annual reports. During years of normal precipitation, the discharge varies between about 3 and 6 cubic feet per second, with the long-term average discharge being about four cubic feet per second. Some water from the Spiro Tunnel, which usually flows into the East Canyon drainage, may be diverted through ditches into the Pace-Homer Ditch to fulfill water obligations to downstream water users in the Silver Creek drainage.

### 3.4 GROUNDWATER HYDROLOGY

Ground water within the Prospector Square area occurs in both unconsolidated valley fill and consolidated rocks. The unconsolidated valley fill is limited to the lower parts of the area, whereas consolidated rocks form the mountainous terrain surrounding the valley and underlie the unconsolidated valley fill. Although groundwater in the unconsolidated valley fill is not used for municipal and industrial purposes, there is concern about the quality of the water and whether there is a potential for movement into the consolidated rocks. Groundwater in the permeable consolidated rocks, such as the Thaynes Formation, is a primary source of municipal water. Records of observation wells are given in table 1, lithologic logs in table 2, water levels in table 3, and results of slug tests in table 4.

#### 3.4.1 Water in Unconsolidated Valley Fill

Water in the unconsolidated valley fill generally is unconfined but may be semiconfined at depth. The unconsolidated valley fill in the Prospector Square area is primarily of alluvial origin. The deposits generally are poorly sorted and consist of clay, silt, sand, gravel, cobbles, and boulders. Some local deposits of well-sorted, coarse-grained material are present near the Pace-Homer Ditch. The unconsolidated valley fill underlying the Silver Creek Tailings Site is comprised of poorly sorted clay, sand, and gravel, with intermittent layers of clay.

The unconsolidated valley fill ranges in thickness from a few feet near hills and mountain fronts to at least 260 feet at the Pacific Bridge well. The fill is probably less than 20 feet thick where Silver Creek exits the area through a canyon on the east side of the study area.

### 3.4.1.1 Recharge

Recharge to the unconsolidated valley fill is derived from leakage from consolidated rocks, from stream losses from Silver Creek and other ditches, and from infiltration of precipitation and unconsumed irrigation water. Silver Creek is a primary source of recharge during the spring and summer months. Discharge measurements (table 5) show streamflow losses of 15 to 25 percent of the flow during normal to high flows and virtually 100 percent losses during low-flow conditions. Holmes, Thompson, and Enright (1986, p. 14) estimated that recharge to the unconsolidated valley fill from precipitation and unconsumed irrigation water to be 1 acre-foot per acre per year.

### 3.4.1.2 Movement

In theory, the conceptualized direction of groundwater flow in the unconsolidated valley fill would parallel the general slope and direction of the major streams. However, in the Prospector Square area, the water table surface of the shallow, unconsolidated valley-fill aquifer, shown in figure 4, indicates movement of water away from Silver Creek in a northeasterly direction. In the eastern portion of the study area, the general flow direction is to the east, toward the Pace-Homer Ditch. Seasonal water-level fluctuations would not substantially change the configuration of water-table surface and direction of flow.

A downward component of groundwater flow exists at three sites where monitoring wells were completed in the shallow unconsolidated valley fill and near the unconsolidated valley-fill/consolidated-rock contact. The downward vertical hydraulic gradient was measured to be about six feet at wells PS-MW-1s and PS-MW-1d. In the Prospector Square area near Silver Creek, the downward gradient was measured to be greater than 10 feet at wells PS-MW-5 and PS-MW-5d. Toward the east end of the Prospector Square area, the downward gradient was generally three feet as measured at wells PS-MW-7 and PS-MW-7d.

### 3.4.1.3 Discharge

Discharge from the unconsolidated valley fill in the Prospector Square area is primarily through seepage to drains and streams and subsurface outflow. Discharge by evapotranspiration is small. When phreatophyte vegetation was more prevalent, prior to residential development, discharge by evapotranspiration from plants probably was greater.

Seepage to drains and streams -- Drains at the lower end of the area are used to dewater the shallow, unconsolidated valley fill. The discharge from two drains in the immediate area were measured at the time of sampling. During spring and summer months when groundwater levels are near their peak, the combined discharge was approximately 0.4 cubic feet per second; and during winter months, the combined discharge was approximately 0.1 cubic feet per second. A new sewer line that parallels the Pace-Homer Ditch and exits the area along Silver Creek may be considered a drain because the fill around the pipe may provide a conduit of high permeability through which groundwater may readily flow. Data were not collected to estimate discharge from this source.

Seepage from the unconsolidated valley fill to the Pace-Homer Ditch can be calculated by subtracting Dority Spring discharge, the discharge from the

drains, and the flow of any water diverted into the area from the Spiro Tunnel from the discharge at the Parshall flume below Prospector Square. Data necessary for this calculation were collected only during the interference test and the results are discussed later in this report.

Subsurface outflow -- Discharge by subsurface outflow is restricted to the narrow canyon on the eastern side of the area. The saturated thickness of the fill in the area is probably less than 20 feet, the gradient is small, and the permeabilities are low. Thus, the amount of subsurface outflow is small with the exception of the fill around the sewer line, where artificially high permeabilities may allow larger rates of groundwater flow.

#### 3.4.1.4 Seasonal Water-Level Fluctuations

Seasonal water-level fluctuations in the unconsolidated valley fill are a result of fluctuations in recharge and discharge. The degree of fluctuation generally is related to the distance, both vertical and horizontal, from the source of recharge and points of discharge, the permeabilities of the fill, the rates of recharge and discharge, and storage coefficient. Water levels are lowest in winter months when recharge is minimal and are highest in spring months after maximum recharge has occurred due to melting snow and high flows in streams.

Monitoring wells PS-MW-4 and PS-MW-5, near Silver Creek, show large water-level rises in the spring, with most of the remaining monitoring wells showing water level rises of a lesser degree (fig. 5). Well PS-MW-5 responds more rapidly to the influence of Silver Creek than does PS-MW-5d which is open to a deeper zone. During the spring months, the downward hydraulic gradient in these two wells increased from more than 10 feet on February 25, 1988, to over 14 feet on May 5, 1988. Water levels in monitoring wells PS-MW-1d and PS-MW-14 and the Cartier well are not located near Silver Creek, but the rises may be due to increased leakage from other small streams or irrigation ditches in the area. Water-level rises in PS-MW-1d may be due to upward leakage from the underlying consolidated rocks which receive recharge from nearby low-lying hills where the consolidated rocks crop out.

Water-level declines in the monitoring wells generally are gradual and occur over a several-month period during the fall and winter. This indicates that discharge is an ongoing process throughout the year, whereas recharge is concentrated in the late winter-early summer period. The result is rapid water-level rises in the spring and summer followed by gradual declines during the fall and winter.

Generally, water-level fluctuations are smaller in wells located further to the northeast of Silver Creek. This is most noticeable in well PS-MW-11 where the water level only varies by about 1 foot. However, water-level changes in monitoring well PS-MW-9, located in the city park next to the Pace-Homer Ditch, respond rapidly and directly to the amount of flow in the ditch. Similarly, well PS-MW-10, located near Silver Creek east of the Prospector Square area, responds to the flow in the creek.

### 3.4.1.5 Hydraulic Properties

The U.S. Geological Survey performed slug tests on 16 of the 18 monitoring wells installed as part of this study. Monitoring wells PS-MW-13 and PS-MW-14 were not tested because grout probably impregnated the sand pack after completion of the wells, thus, leading to uncertainties in the results. A cylinder was lowered into the 2-inch-diameter monitoring wells and when the waste level in the well had returned to the original level, the cylinder was removed quickly and the recovering water levels were recorded at 2-second intervals using a pressure transducer and an electric data-logger. The data were analyzed using methods described by Bouwer and Rice (1976) and Cooper and others (1967). The solution described by Bouwer and Rice (1976), which was developed for unconfined conditions, is based on the assumption that the aquifer is isotropic; the solution omits storage in the aquifer, and treats the water table as a fixed, constant-head boundary. The solution described by Cooper and Others (1967) is based on the assumption that the aquifer is confined, isotropic, and not leaky. The monitoring wells tested in the Prospector Square area represent partially-penetrating piezometers in an anisotropic, unconfined aquifer, and, therefore, an appropriate analytical solution to the boundary conditions does not exist. As a result, the values for hydraulic conductivity in table 4 have been rounded to the nearest whole number, and, in some instances, where the data poorly matched the type curves, the values have been rounded to the nearest order of magnitude.

The values of hydraulic conductivity listed in table 4 were calculated based on the length of the production zone which is the thickness of the sand pack and this thickness varies in each monitoring well. The range of values for hydraulic conductivity, 1 to 14 feet per day, is similar to that representative of fine sands, silts, and mixtures of sand, silt and clay; and according to Chow (1964, p. 13-10), this range is representative of poor or the lower end of good aquifers, with three feet per day being the value separating poor from good aquifers. In wells at which the water-bearing material has a hydraulic conductivity of three feet per day or less, the predominant lithology is clay with interbedded silt, fine sand, and gravel. Wells at which the water-bearing material has a hydraulic conductivity of greater than three feet per day, the predominant lithology is the same, but layers of sand or sand and gravel may be present within the production interval.

The vertical hydraulic conductivity probably can be assumed to be at least one order of magnitude smaller than the horizontal hydraulic conductivity. Assuming one feet per day is representative of unsorted clay, sand, and gravel, then the vertical hydraulic conductivity probably would not be greater than 0.1 feet per day. This value could be considerably smaller where layers of clay are present.

### 3.4.2 Water in Consolidated Rocks

Consolidated rocks in the Prospector Square area are an important source of water due to their large areal extent and ability, locally, to yield large quantities of water to wells. The consolidated rocks crop out or are covered by a thin layer of unconsolidated valley fill in the higher altitudes of the area and in a large portion of the valley floor.

Extrusive igneous rocks of Tertiary age are present in the northeast corner of the study area but are not hydrologically important. However, most of the consolidated rocks are fractured with the movement of water primarily along these fractures. Consolidated rocks which yield the most water are Limestone, in which fractures have been enlarged by solution dissolution.

#### 3.4.2.1 Recharge

Recharge to the consolidated rocks which underlie the Prospector Square area is primarily from precipitation and stream infiltration and occurs in the high-altitude areas bordering the western and southwestern part of the study area. Most of the precipitation, which exceeds 40 inches per year in the highest parts of the tributary area, falls as snow during winter and spring. Recharge to the consolidated rocks occurs after the soil crust has thawed sufficiently and soil moisture reaches saturation, thus allowing water to infiltrate through the thin veneer of soil. Recharge to the consolidated rocks due to stream losses also occurs in higher altitudes. Holmes, Thompson, and Enright (1986, p. 22) reported that these losses can be inferred if streamflow from a drainage basin is significantly smaller than the streamflow estimated from empirical equations incorporating drainage area and precipitation. Thaynes Canyon Creek, which heads in the mountains west of the Prospector Square area, generally has a smaller streamflow than would be expected and is probably a major source of recharge to the Thaynes Formation.

#### 3.4.2.2 Movement

Water in the consolidated rocks generally moves from recharge areas at high altitudes to the discharge area at low altitudes. Water moves along faults and fractures due to the lack of primary permeability in consolidated rocks. Drain and mine tunnels have changed the direction of groundwater movement in some consolidated-rock formations. In some portions of the consolidated rock adjacent to the tunnels, groundwater now moves toward and discharges to these tunnels. Within the study area, not enough water-level information exists from the consolidated rocks underlying the unconsolidated valley fill to determine the direction of groundwater movement from one rock formation to another.

An upward vertical hydraulic gradient exists between the Woodside Shale and the overlying unconsolidated valley fill in the vicinity of the Pacific Bridge well. Water-level measurements at the Pacific Bridge well and the adjacent monitoring well, PS-MW-2, show an upward gradient of over 10 feet during the winter months and over 17 feet in early May (Table 3). Although data are available only in this local area, an upward gradient between the consolidated rocks and the overlying valley fill probably exists throughout most of the Prospector Square area.

A downward gradient in the unconsolidated valley fill, mentioned previously, and an upward gradient between consolidated rocks and the unconsolidated valley fill indicates the possible existance of a layer of well-sorted material at the base of the unconsolidated valley fill which can transmit water.

### 3.4.2.3 Discharge

Discharge from the consolidated rocks within the study area is primarily by springs, wells, and upward leakage to the unconsolidated valley fill. Several springs discharge from the Thaynes Formation at higher altitudes, but only one major spring, Dority Spring, has substantial discharge in the valley. Provided the Park Meadows well is not used, the flow from Dority spring may vary from about 0.5 to 2 cubic feet per second. Two wells are completed in consolidated rocks in the study area, but only the Park Meadows well, completed in the Thaynes Formation, is used when other sources for the municipal system do not provide enough water to meet demand. Discharge from the Park Meadows well may be as much as 1,200 gallons per minute. Due to low transmissivity and storage in the Woodside Shale and thus low yield, the Pacific Bridge well is not used as a source of municipal water.

### 3.4.2.4 Seasonal Water-Level Fluctuations

Seasonal fluctuations in the consolidated-rock aquifers are related to recharge at high altitudes and hydraulic properties of the rocks. Water-level fluctuations in the Pacific Bridge well, completed in the Woodside Shale, are quite large. Data collected during this study show a seasonal change of 14 feet, and data reported by Holmes, Thompson, and Enright (1986, p. 65) show a seasonal change of almost 23 feet. In contrast, seasonal fluctuations in the Park Meadows well completed in the Thaynes Formation are small. Water-level data collected by Holmes, Thompson, and Enright (1986, p. 65) indicate a seasonal variation of slightly more than three feet at a time when the Park Meadows well was not being used for municipal water.

### 3.4.2.5 Hydraulic Properties

Previously reported transmissivity values for the Thaynes Formation (Holmes, Thompson, and Enright; 1986, p. 67), which are based on aquifer tests, ranged from 2,400 to 7,400 feet squared per day. They reported that the transmissivity differences are due to the magnitude and number of fractures and solution openings rather than the inherent primary permeability of the rock. Additional transmissivity values for rocks in the Prospector Square area include 360 feet squared per day for the Weber Quartzite, 280 feet squared per day for the Woodside Shale, 200 feet squared per day for the Nugget Sandstone, and three to 73 feet squared per day for the Tertiary extrusive igneous rocks (Holmes, Thompson, Enright; 1986, p. 67). No aquifer test data are available for the Ankareh Formation and the Park City Formation. Due to the lack of peripheral observation wells during the tests mentioned above, values for storage could not be determined.

## 4.0 FIELD ACTIVITIES

### 4.1 DRILLING

Drilling was done in two phases. Phase I took place in July 1987 with the installation of two deep and eleven shallow monitoring wells. These wells were monitored to study the water quality at the site. Phase II drilling was done in January and February 1988 to install 5 deep wells. Phase II wells were drilled as part of an interference (pump) test which is discussed in section 5.0 of this report. Drilling activities reports are included in Attachment A.

## 4.2 SLUG TESTS

The USGS performed slug tests to calculate hydraulic conductivities. The results of these test are listed in Table 4 and are described in Section 3.4.1.5. of this report.

## 4.3 SAMPLE COLLECTION

The overall scope of the investigation involved the collection of 13 groundwater samples, 2 drain samples 5 surface water samples, 4 sediment samples, and 8 tailings samples. Tailings samples were collected during July-August 1987. Groundwater samples were collected in September 1987, December 1987, February 1988 and April 1988. Surface water/sediment samples were collected during April 1987, July 1987 and April 1988. Samples were collected at various intervals to observe possible seasonal variations in the water quality.

An approved work plan, sampling plan and health and safety plan was submitted to EPA and Park City on May 18, 1987. Performance evaluation, rinsate blank, field blank and duplicate samples were submitted to the laboratory with each set of samples. Additionally, each sample was split between the State of Utah, U.S. EPA and the U.S. Geological Survey. The State of Utah samples were analyzed by the State Health Laboratory, Salt Lake City, Utah. The U.S. EPA samples were analyzed by various contract laboratories, and the U.S. Geological survey samples were analyzed by the USGS Laboratory, Denver, Colorado.

Les Springer, U.S. EPA Environmental Services Division, conducted a field audit during the first round of groundwater sampling. He indicated that samples were being collected in accordance with the sampling plan and data obtained from these samples should be legally defensible. His report is included in Attachment B.

### 4.3.1 Ground-Water Samples

Ground-water samples for chemical analysis were collected on four separate occasions after the installation of the monitoring-well network. The first sampling occurred at the end of August and beginning of September 1987 before groundwater levels had begun the seasonal decline (fig. 5). Subsequent samplings took place at the beginning of December 1987, the end of February 1988, and the middle of April 1988. The two rounds of sampling during the winter occurred while groundwater levels were at a minimum; and the April sampling occurred while the overall groundwater levels were near their yearly highs.

The groundwater sampling procedure involved several specific tasks. Water-level measurements were made to determine the amount of water within the well casing. Three to five casing volumes of water subsequently were pumped from the well. During the first round of sampling, all purged water was contained pending the results of the chemical analyses. Temperature, pH, and specific conductance were measured at all sites during each sampling round. During the first round of sampling, alkalinity was determined and compared to values of alkalinity determined in the lab. Both values compared favorably for water from all wells and, therefore, field alkalinity determinations were

eliminated during the remaining rounds. Filtered samples were collected to determine concentrations of dissolved constituents. Unfiltered samples were collected for alkalinity, cyanide, chloride, and sulfate. The U.S. Geological Survey lab uses filtered water for chloride and sulfate determinations. In contrast, the State lab and the EPA contract labs use unfiltered water for these constituents. Monitoring well PS-MW-1s (background) was not sampled during the third round due to flooding from melting snow.

Large pH values in water from two monitoring wells, wells PS-MW-13 and PS-MW-14, indicated that the grout used in well installation moved around the bentonite seal and impregnated the sand pack. Therefore, these wells were not sampled to determine the quality of water due to the uncertainty of the results.

#### 4.3.2 Surface Water/Sediment Samples

Five surface water sampling sites were established to monitor the quality of surface water above and below the tailings site. On both Silver Creek and the Pace-Homer Ditch, a site was located above and below the tailings site with the fifth site located downstream from the point where water from the Pace-Homer Ditch can be diverted into Silver Creek. Samples were collected at high, medium, and low flows for the period of the project. However, below-normal snowpack for the last two years has resulted in below normal runoff, and the flows observed during this study are probably not representative of long-term average flows.

During the sampling procedure, both filtered and unfiltered samples were collected for the analysis of dissolved and total constituents. Grab samples were taken rather than an integrated sample due to the small cross-sectional area of flow in the streams. Sediment samples also were collected from the banks of the streams at the surface water-air contact at the same time. Field measurements of stream discharge, temperature, specific conductance, pH, and alkalinity were measured at each sampling site (Table 5).

#### 4.3.3 Tailings Characterization

Mill tailings were deposited in the Prospector Square area beginning in the early 1900's and continuing through the 1930's. Subsequently, in the 1940's, the mill tailings were reworked using an in-situ extraction process for the recovery of residual silver. The present sporadic occurrence of the mill tailings as shown by test-drilling during this study is a direct result of the reworking process. Tailings were encountered in three of the nine wells completed in the immediate mill tailings area. Tailings from wells PS-MW-3 and PS-MW-5 appeared to have been reworked and had the appearance of well-sorted, fine- to medium-grained, brown sand. In contrast, the tailings from well PS-MW-9 did not appear to have been reworked due to the presence of sphalerite and various forms of pyrite. The thickness of each tailings interval encountered is listed in table 1. Chemical analyses from a total metal extraction are listed in table 10. Ecology and Environment, Inc., the Field Investigation Team contracted by the EPA, has estimated the volume of mill tailings to be 46,740 cubic yards using an average tailings thickness of five feet and an area of 45 acres. However, this estimate may be considered high because tailings were only encountered in three of the nine monitoring wells during drilling.

## 5.0 AQUIFER INTERFERENCE TEST

As part of this study, an interference test was completed to determine the possible effects of pumping the municipal Park Meadows well on the water levels in the unconsolidated valley-fill deposits overlying the Thaynes Formation and in the adjoining tailings area. The primary question to be addressed was whether water in the unconsolidated valley fill underlying the Silver Creek Tailings site could move toward and into the Thaynes Formation and possibly contaminate the water withdrawn from the Park Meadows well.

To help answer these questions, an aquifer interference test was designed that involved pumping the Park Meadows well for 72 hours followed by 72 hours of recovery. To help determine effects on water levels near the Park Meadows well, two additional monitoring wells, located between the tailings area and the Park Meadows well, were drilled and completed near the base of the unconsolidated valley fill. In addition, three monitoring wells were completed at depths of 95, 138, and 85 feet in the unconsolidated valley fill underlying the tailings area. These five wells, plus the original 13 monitoring wells, the Pacific Bridge well, the Cartier well, Dority Spring pond and weir, and Pace Homer Ditch staff and flume were monitored during the test (fig. 2a, 2b). Water levels were measured in all wells for seven days prior to the test to establish water-level trends. Wells PS-MW-1d, PS-MW-13, and PS-MW-14 were equipped with pressure transducers and data-loggers to give continuous readings of water levels. Additional recorders were used to measure gage height at Dority Spring pond and discharge at Dority Spring weir continually. All other wells and the Pace-Homer Ditch staff gage and flume were measured every two hours during the first 12 hours of the test, every four hours for the next 24 hours, and approximately every 12 hours for the remaining 36 hours. All recorders were operated for several days after the pump was shut off, and periodic measurements were made at the other data collection sites.

No major problems occurred during the test. The pump maintained a discharge rate of approximately 1200 gallons per minute during the test except when the pump shut down for approximately two hours after about 45 hours of pumping. The water level in the Park Meadows well recovered slightly (Attachment E); but no effects were seen at other wells. Weather conditions were ideal throughout the test with no warm temperatures causing excessive melting of snow which could have made it difficult to determine some of the effects on the streams in the area.

Water levels measured before, during, and after the pumping period (Attachment E) show that water levels in the Cartier Well and wells PS-MW-13 and PS-MW-14 were definitely affected by the pumping of the Park Meadows well. The greatest decline, about five feet, was recorded at well PS-MW-13. The water level in wells PS-MW-14 declined about two feet as did the level in the Cartier well which went dry on the second day of the test and remained dry for approximately 48 hours after pumping ceased.

Similar to the effects of previous interference tests, the pond at Dority Spring went dry and discharge ceased during the 72 hour test. Due to pumping of the Park Meadows Well, the water level in the Thaynes Formation was lowered such that discharge from the spring ceased after approximately 48 hours. About 24 hours elapsed after the pump was turned off before discharge from the

spring resumed. Measured spring discharge at the weir, about 150 feet downstream from the pond, resumed more than 72 hours before water began appearing in the pond due to an underground pipe which intercepts some discharge underneath the pond and delivers it to the channel downstream.

Water-level changes in the Pacific Bridge Well and well PS-MW-1d were due to changes in barometric pressure. Fluctuations in barometric pressure are plotted inversely (increase in pressure downward) on graphs which show both water-level change and barometric pressure (Fig. 6). Therefore, if water-level change was a function of barometric pressure, both curves should follow the same trend. This is very evident in the combined plot for the Pacific Bridge Well.

To observe any effects in the Pace-Homer Ditch due to the pumping, both a staff gage near well PS-MW-11 and a Parshall flume were monitored throughout the test. During the test, the water level in the Pace-Homer Ditch declined by 0.14 feet as measured at the staff gage. Flow in the Pace-Homer Ditch declined by 0.6 cubic feet per second, of which about 0.4 cubic feet per second was due to the elimination of discharge from Dority Spring. The remaining 0.2 cubic feet per second possibly may be due to a decrease in discharge from the unconsolidated valley fill and the Thaynes Formation into the Pace-Homer Ditch.

Wells PS-MW-9, located in the City Park at the lower end of the Prospector Square area, was affected during the test. Due to its close proximity to the Pace-Homer Ditch, water-level changes in this well are directly a result of decreased flow in the ditch. This relation is shown graphically in the plot which compares water level in PS-MW-9 to gage height as measured at the staff gage in the Pace-Homer Ditch.

Small fluctuations in PS-MW-1s, PS-MW-1d, PS-MW-2, PS-MW-3, PS-MW-4, PS-MW-7d, and PS-MW-11d may have been due to pumping of the Park Meadows well or changes in recharge due to surface runoff of melting snowpack prior to the test and the lack of runoff during the test, or a combination of the two, but data were insufficient to identify the specific causes.

Effects due to pumping of the Park Meadows well appear to be limited to the unconsolidated valley fill overlying the Thaynes Formation. Observation wells located in Prospector Square are completed in the unconsolidated valley fill overlying the Woodside Shale and apparently are not affected by the pumping. Therefore, the pumping of the Park Meadows well does not cause water-level declines in the Woodside Shale and the overlying unconsolidated valley fill. Water-level declines in the unconsolidated valley fill above the Thaynes Formation are not sufficiently large to cause an effect in the unconsolidated valley fill overlying the Woodside Shale.

## 6.0 ANALYTICAL RESULTS

The results of analyses are shown in Tables 5 through 9. Samples were analyzed for Hazardous Substance Metals. Samples collected by EPA were sent to the Contract Laboratory Program (CLP) for analyses. Samples collected by the State of Utah were sent to the State Health Laboratory (SHL), Salt Lake City, Utah. The U.S.G.S. collected a selected number of samples, and these samples were sent to the U.S.G.S. laboratory in Denver, Colorado.

## 7.0 QUALITY ASSURANCE

The following steps were taken regarding the date quality assurance.

1. A detailed sampling plan (with input and consent from all parties) was prepared and followed during the field activities.

2. U. S. EPA Region VIII, Environmental Services Division conducted a field audit during the first round of groundwater sampling and concluded that the date collected during this investigation should be valid and defensible.

3. Field blanks, decontamination blanks and duplicate samples (as specified in the sampling plan) were collected for each round of sampling. A brief discussion of these results is given below. Data validation summaries stating spike recoveries, duplicate sample results and other quality control criteria are included in Attachment I.

### 7.1 GROUNDWATER

#### 7.1.1 Round I

A duplicate sample was collected from MW-12. SHL analyses show relative percent differences (RPDs) less than 20% for each parameter except for iron and zinc. CLP data show RPD less than 20% for each parameter except for calcium, magnesium, manganese, potassium, and sodium. No contamination was found in the field blank and decontamination blank analyzed by the SHL and CLP. CLP data for barium, lead, selenium, silver and vanadium were partially qualified but usable.

#### 7.1.2 Round II

A duplicate sample was collected from MW-9. SHL analyses show RPD less than 20% for each parameter. CLP data show RPD less than 20% for each parameter except for arsenic, iron, and sodium. CLP and SHL did not detect any contamination in field blank and decontamination blank. All the contaminants levels in the blanks were at or below their detection limit. A performance evaluation sample was submitted to CLP. Results for the performance evaluation sample were within the 95% confidence interval except for nickel, vanadium and zinc. All values reported by the SHL are within the 95% confidence interval.

Some cadmium data analyzed by the SHL did not match closely with the CLP and USGS lab and was flagged with a star (\*). CLP data were partially qualified but useable.

#### 7.1.3 Round III

A duplicate sample was collected from MW11. SHL analyses show RPD less than 20% for each parameter except for iron and zinc. CLP data show RPD less than 20% for each parameter except for cadmium, copper, lead, and mercury. SHL did not detect any contamination in the rinsate blank except for iron and zinc. A slightly higher value than the detection limit for cadmium was detected in the rinsate blank analyzed by the CLP. All values reported by the CLP for the performance evaluation sample were within the 95% confidence interval except for lead, mercury, nickel and vanadium. CLP data were partially qualified but useable.

#### 7.1.4 Round IV

A duplicate sample was collected from MW11D. SHL analysis show RPD less than 20% for each parameters. CLP analysis indicate RPD less than 20% for each parameter. CLP and SHL did not detect any contamination in the field blank and decontamination blank. All the contaminant levels in the blanks were at or below the detection limit. Two performance evaluation samples (low range and high range) were submitted to SHL and CLP. SHL and CLP reported most values within the 95% confidence interval.

#### 7.2 SURFACE WATER/SEDIMENT

Surface water/sediment samples were collected for three rounds. Surface water samples were analyzed for total and dissolved metals. The last round of surface water/sediment samples were collected in conjunction with the last round of groundwater samples. RPD's for duplicate samples were within 20% with a few exception and no contamination was found in the blanks.

### 8.0 DISCUSSION OF ANALYTICAL RESULTS

The objectives of this section are (1) to summarize the analytical results for the samples collected during groundwater, surface water, sediment and soil sampling and (2) to determine whether hazardous substances have been released from the site to the environment.

#### 8.1 WASTE CHARACTERIZATION

Mill tailings were deposited in the Prospector Square area beginning in the early 1900's and continuing through the 1930's. Subsequently, in the 1940's, the mill tailings were reworked using an in-situ extraction process for the recovery of residual silver. The sporadic occurrence of the mill tailings as shown by test-drilling during this study is a direct result of the reworking process. Tailings were encountered in three of the nine monitoring wells completed in the immediate mill tailings area as shown in figure 2a. However, due to the reworking process, tailings may be present out of the original tailings pond area and the outline shown in figure 2a should be considered as the minimal areal extent. Tailings from monitoring wells PS-MW-3 and PS-MW-5 appeared to have been reworked and had the appearance of well-sorted, fine-to medium-grained, brown sand. In contrast, the tailings from monitoring well PS-MW-9 did not appear to have been reworked based on the presence of sphalerite and various forms of pyrite. The thickness of each tailings interval encountered is listed in table 1. Chemical analyses from a total metal extraction are listed in table 10. Ecology and Environmet, Inc., the Field Investigation Team contracted by the U.S. Environmental Protection Agency, has estimated the volume of mill tailings to be 46, 740 cubic yards using an average thickness of 5 feet. Due to the sporadic deposits of tailings, the assumed average thicknedd may be too large, thus, resulting in an overestimate for the tailings volume.

#### 8.2 GROUNDWATER DATA

Chemical analyses of the water collected from the monitoring wells and drains indicate that the concentrations of major ions vary areally and vertically within the unconsolidated valley fill (Table 9). In water from

most of the monitoring wells and drains, the prevalent ions were calcium and sulfate, except in a few wells where sodium and chloride predominated as shown in the trilinear diagram (Fig. 7). In water from monitoring well PS-MW-1s, the concentration of sodium was similar to the concentration of calcium, and the concentration of chloride was much greater than the concentration of sulfate. As expected, the specific conductance of the water in this well was large due to dissolved-solids concentration. The anomalous dissolved-solids concentration in water from this well compared to water from other wells in the Prospector Square area may be due to the storage of snow removed from city streets at this location. Road salt contained in the snow probably dissolved as the snow melted in the spring and the resulting melt water containing large concentrations of sodium and chloride infiltrated into the unconsolidated valley fill.

Water from monitoring well PS-MW-1d, which is next to monitoring well PS-MW-1s, also had a chloride concentration in excess of that of sulfate, but the concentrations similar to those in water from monitoring well PS-MW-1d were detected in water from monitoring well PS-MW-2, and concentrations similar to those in water from monitoring well PS-MW-1s were detected in water from PS-MW-3, but to a lesser degree. Monitoring well PS-MW-3 is located adjacent to Kearns Boulevard and water in this well also may be affected by the infiltration of water containing sodium and chloride from road salt. The monitoring wells that were completed near the base of the unconsolidated valley fill, with the exception of well PS-MW-1d, generally yield water with low specific conductance values and wells PS-MW-5d, PS-MW-7d, PS-MW-11d, and PS-MW-12. The water from monitoring well PS-MW-5d, similar to that from wells completed in the shallow unconsolidated valley fill, has calcium and sulfate as the most prevalent ions, but in lower concentrations. The water from monitoring wells PS-MW-7d and PS-MW-11d had calcium and bicarbonate as the most prevalent ions. The presence of bicarbonate and sulfate as the most prevalent ions. The low dissolved-solids concentrations in water derived from the base of the unconsolidated valley fill beneath the Silver Creek Tailings Site may indicate that ground water in the shallow unconsolidated valley fill does not appear to move downward even though the hydraulic gradient is downward. If water from the shallow unconsolidated valley fill is moving downward, then the quantity of water is probably small and it is diluted at depth.

Concentrations greater than background levels for dissolved zinc were detected in water from six monitoring wells and one drain, and concentrations greater than background levels for dissolved manganese were detected in water from three monitoring wells and both drains. The dissolved-zinc concentration in water from monitoring wells PS-MW-4, PS-MW-5, and PS-MW-10 varied seasonally with the largest concentrations coinciding with high groundwater levels. The dissolved manganese concentration in water from monitoring wells PS-MW-4, PS-MW-5, and PS-MW-10 and drain PD-DR-2 also varied seasonally, but, unlike zinc, the highest concentrations coincided with the lowest ground-water levels. However, the dissolved-manganese concentration in water from monitoring well PS-MW-10 followed the same pattern as that for dissolved zinc with the highest concentration coinciding with high ground-water levels. The high dissolved-zinc concentrations may be related to the influx of water during the spring months with slightly low pH and more dissolved oxygen. Zinc may be more soluble under these conditions. In contrast, the high dissolved-manganese concentrations may be related to reducing conditions during the winter months, which coincide with low ground-water levels. This

is evident in water from drain PS-DR-2, where the concentrations of iron and manganese were high in December 1987.

### 8.3 STATISTICAL EVALUATION

Four rounds of ground water samples were collected during September and December 1987 and February and April 1988. The analytical results were reviewed, and questionable data points identified and flagged. Inspection of the data indicated that for most metal parameters the downgradient water quality is comparable to the upgradient water quality. Arsenic, Cadmium, chromium, manganese, and zinc, however, exhibited some differences in concentrations between upgradient and downgradient locations. Statistical testing was performed only for those parameters to determine whether the differences were significant.

For each of the parameters, comparison was made between the combined values from the upgradient or background wells and the combined values for all downgradient wells for each round of sampling and for each agency's data separately. Questionable data was not used in the calculations and where data was reported as less than a particular detection limit value, one-half of the value and less than detection limit values as such were employed to perform the calculations.

The wells which were considered upgradient or background consisted of MW 1S, 1D, 12. The wells which were grouped to form the downgradient population include MW 2, 3, 4, 5, 6, 7, 8, 9 and 11. During Rounds 3 and 4, MW 5D, 7D, and 11D were also included in the downgradient group. Well PS-MW-10 which is located on Silver Maple Claim Property (another CERCLA site) and Drains 1 and 2 were sampled for informational purposes, but were not included in the statistical evaluation.

Cochran's approximation for the Behrens-Fisher Students t-test at the 95 percent confidence level was the statistical methodology employed to make comparisons between concentrations in the upgradient versus downgradient groups of wells. This method was selected because of the small sample size, and it's use in the Resource Conservation and Recovery Act (RCRA) program for the last 8 years to assess similar situations.

During Round 3, one of the upgradient wells (MW 1S) could not be sampled because of flooding problems and the lack of this date prevented any statistical testing during this round. In addition, questionable data, which was not used in the statistical evaluations, or lack of data prevented comparisons being made with particular agency data during other rounds. No statistically significant increases over background levels were found in any of the data sets for arsenic and chromium.

For cadmium, statistically significant increases over background were calculated in Round 1, (USGS and EPA data; insufficient State data), and Round 2, (EPA data; insufficient State and USGS data). As noted, Round 3 data could not be evaluated. Neither the State nor the EPA data (USGS data was insufficient) indicated a significant increase in Round 4. The significant increases over background for cadmium seem to be largely due to the contribution from MW8 where concentrations ranged from 14 to 20 ug/l. This is the only well in which any valid cadmium concentrations exceed the primary drinking water standard of 10 ug/l.

Statistically significant increases over background for manganese were calculated in round 2 and 4 (State and EPA data; insufficient USGS data). The major contributors to this increase appear to be MW9 with concentrations of 1,300 to 1,500 ug/l and MW4 with concentrations of 1,800 to 2,250 ug/l during Round 2. Most of the downgradient and many of the upgradient manganese values during all sampling rounds are in excess of the secondary drinking water standard of 50 ug/l. This is not a health-based standard but rather is based upon the staining properties of manganese which may be manifest at this and higher concentrations.

The zinc data showed statistical increases over background during Round 1 (all three data sets), and Round 2 and 4 (State and EPA data; USGS data insufficient). Wells MW 4, 5, 6, 7 and 8 were those which had the largest increases over background with individual values in the 2,000 to 3,000 ug/l range. However, it should be noted that even the highest value detected, 3,210 ug/l, is still well below the secondary drinking water standard of 5,000 ug/l.

#### 8.4 SURFACE-WATER SEDIMENT DATA

The quality of water in the Silver Creek drainage is quite different from that of water in the Pace-Homer Ditch, reflecting the different origins of the water. Water in Silver Creek upstream from the point where water from the Pace-Homer Ditch can enter Silver Creek has a larger specific conductance than the water in the ditch. Similarly, pH in Silver Creek generally is greater; however, the alkalinity is less than in the Pace-Homer Ditch. The major ions appear to be different for the stream and ditch (Table 6); but this may not necessarily be true. During high flows in the spring, the major ions in Silver Creek are sodium and chloride, but during low-flows in the summer, the major ions are calcium and sulfate. The presence of sodium and chloride in the spring may be due to surface runoff of water containing dissolved road salt. In the Pace-Homer Ditch, the major ions are calcium and sulfate regardless of the volume of flow.

The water at the sampling site on Silver Creek downstream from Prospector Square (Fig. 2b) consists of water from several sources, and generally reflects the water chemistry of the primary source at the time of sampling. During surface-water sampling in April 1987 and in April 1988, both Silver Creek and the Pace-Homer Ditch contributed water for the combined site. As expected, specific conductance, pH, and alkalinity were less during both April samplings than during the low flow sampling in July 1987, when Silver Creek was dry downstream from Wyatt Earp Drive.

Chemical analyses of filtered water collected from surface-water sites indicated that concentrations of dissolved cadmium, manganese, and zinc were greater than background concentrations only during low-flow conditions (Table 6). Concentrations of dissolved cadmium, manganese, and zinc that were greater than background were not detected during low flow at the upstream site on Silver Creek at Bonzana Drive; but the water collected during low flow from Silver creek at Wyatt Earp Drive had concentrations of dissolved manganese and zinc that were about 10 times greater than concentrations measured during average or high flow. Similarly, the dissolved-cadmium concentration at this site was about 15 micrograms per liter at low flow; whereas, only about 2 micrograms per liter cadmium was detected during high flow.

Water collected at the site on Silver Creek downstream from Prospector Square also had concentrations of dissolved manganese and zinc that were greater than background concentrations along with a detectable concentration of dissolved cadmium during low flow; however, the concentrations were less than those at the site at Wyatt Earp Drive. As mentioned above, Silver Creek was dry downstream from Wyatt Earp Drive, and the primary source for the water at the site on Silver Creek downstream from Prospector Square appears to have been drain PS-DR-1. Similar values of specific conductance and alkalinity along with similar values of specific conductance and alkalinity along with similar concentrations of dissolved cadmium, manganese, and zinc in water at the site on Silver Creek downstream from Prospector Square and in water from drain PS-DR-1 support the conclusion that little or no water was being contributed by flow in the Pace-Homer Ditch.

Despite more than 2 cubic feet per second of flow in the Pace-Homer Ditch, practically all of this water continued down the ditch with only a small quantity leaking into Silver Creek. Therefore, in July 1987, water at the site on Silver Creek downstream from Prospector Square appears to be from drain PS-DR-1, which discharges into Silver Creek downstream from the City Park.

Chemical analyses of unfiltered water collected at the surface-water sites have concentrations (table 7) similar to those detected in the filtered water (table 6). The only substantial differences are the much greater concentrations of total iron and lead in unfiltered samples collected at the three sites along Silver Creek. During the first round of surface-water sampling in April 1987, total-iron and total-lead concentrations were largest at the upstream site at Bonzana Drive and decreased downstream. The concentrations of these constituents also decreased in subsequent rounds of sampling at all sites on Silver creek. Therefore, the suspended iron and lead in the water appears to be due to a disturbance of surficial deposits upstream prior to the first round of sampling, which was not repeated prior to later rounds of sampling.

Chemical analyses of stream sediment are presented in table 8. Varying concentrations of all selected metals were present, with the largest concentrations being total-recoverable iron, lead, manganese, and zinc. No distinct pattern among sites and sampling rounds is apparent. Sediment from the site on the Pace-Homer Ditch downstream from Prospector Square had concentrations similar to the sites on Silver Creek, indicating that the ditch, like Silver Creek, is probably cut through tailings.

## 9.0 TARGETS

### 9.1 GROUNDWATER ROUTE

Park City draws its municipal water from mine tunnels and the Park Meadows well. The Park Meadows well is located within a 3-mile radius from the site and is completed in the Thaynes Formation. The Pacific Bridge well is the only well located on site but it is no longer in use. The residents of Prospector Square receive their drinking water from the Park City Public water supply system. The Cartier well (a shallow hand dug well) is also located within a 3-mile radius from the site, but it is not currently being used for drinking water purposes.

The aquifer of concern in this area is the Thaynes Formation, in which the Park Meadows well is located. Based on current hydrologic conditions, groundwater underlying the tailings area does not appear to be moving towards the Park Meadows well. Therefore, it appears that there is no target population for the groundwater route.

## 9.2 SURFACE WATER ROUTE

The Silver Maple Claim Property (another CERCLA site) is located downstream of Prospector Square adjacent to its eastern boundary. Silver Creek flows through the Silver Maple Claim site after it exits the Prospector Square area. Silver Creek then flows east about two miles to Richardson Flat (an NPL site). Currently there are no known uses of Silver Creek between Prospector Square and Richardson Flat. The target population for the surface water route appears to be minimum to non-existent.

## 10.0 CONCLUSIONS

Based on the date collected, the following conclusions may be drawn from the study:

### 10.1 TAILINGS CHARACTERIZATION

1. It is estimated that 46,740 cubic yards of tailings are present on site.
2. The tailings contain elevated levels of arsenic, cadmium, chromium, iron, lead, manganese, zinc and other metals as shown in Table 10.

### 10.2 GROUNDWATER

1. The ground water sampling data were collected for four rounds (September, 1987; December, 1987; February, 1988; and April, 1988). Samples were split among USGS, EPA and State of Utah. Data indicate a statistically significant release for zinc for each round of sampling. Some data also indicate statistically significant releases for cadmium and manganese. However, these releases (cadmium and manganese) were not observed during each round and were not supported by all data. Downgradient water quality appears to be comparable to the background for all metals except zinc, cadmium, and manganese.
2. The primary drinking water standards were met for all parameters in all wells except well PS-MW-8 (downgradient) which exceeded the standard for cadmium. The secondary drinking water standard for iron was met in all upgradient locations, but was exceeded in PS-MW-9.
3. The interference test (pump test) results show that water levels in the onsite monitoring wells (except MW-9 which is influenced by the flow of Pace Homer Ditch) were not significantly impacted by the pumping of the Park Meadows Well. Based on the present hydrologic conditions in the unconsolidated valley fill such as hydraulic gradient, horizontal and vertical hydraulic conductivities, and the present distribution of ground-water withdrawal from the consolidated

rocks, water underlying the tailings area does not appear to be moving toward the Park Meadows Well (see section 3.4 of text).

### 10.3 SURFACE WATER

1. The downstream surface water quality for Silver Creek is comparable to background except for cadmium, manganese, and zinc in both filtered and unfiltered samples. During the second round of sampling, ten fold increases in concentrations of these metals were observed downstream as compared to upstream samples. However, due to the lack of an adequate number of samples, it can not be determined if a statistically significant release has occurred. The surface water quality in Pace-Homer Ditch is comparable in both upstream and downstream locations for filtered and unfiltered samples.
2. The primary drinking water standard for cadmium was exceeded at the downstream location on Silver Creek for the filtered and unfiltered samples.
3. The Silver Creek is classified as 3A, 1C, and 4 by the State of Utah. Cadmium levels during the second round of sampling downstream on Silver Creek were elevated compared to the 3A, 1C, and 4 classification standards. However, the classification standards are established for a one hour composite sample, and during the sampling activity for this study only grab samples were collected.

### 11.0 RECOMMENDATIONS

1. Data collected during the groundwater investigation indicate that the tailings in the Prospector Square area are affecting groundwater quality in the unconsolidated valley fill. However, under current hydrologic conditions, groundwater in the Prospector Square area does not appear to be moving toward the Park Meadows Well. In addition, groundwater analyses in the Prospector Square area indicate that drinking water standards were exceeded only in well PS-MW-8.

It is therefore recommended that future groundwater development in the area be closely monitored to ensure that existing groundwater sources are not adversely impacted by migration of groundwater from the Prospector Square area into usable water sources. In addition, groundwater development in the unconsolidated valley fill underlying Prospector Square should be prohibited. It also is recommended that existing geohydrologic relationships be monitored to ensure that conditions do not change in a manner that will result in migration of contaminated groundwater into useable groundwater sources.

2. Data collected during the surface water investigation indicate that the tailings in the Prospector Square area are affecting the water quality of Silver Creek, and that the drinking water standard for cadmium is exceeded in Silver Creek near the eastern side of Prospector Square. In addition, Silver Creek is classified as 3A, 1C and 4 by the Utah Bureau of Water Pollution Control and the data indicates that cadmium standards for these classifications may also be exceeded. Therefore, action should be taken that will eliminate contact between Silver Creek and the tailings material.

#### ACKNOWLEDGEMENT

Sections 3.2, 3.3, 3.4, 4.3.1, 4.3.2, 4.3.3, 5.0, 8.1, and 8.2 of this report were prepared by the U.S. Geological Survey. Drilling reports were prepared by Ecology and Environment, Inc. (Field Investigation Team).

#### REFERENCES

- Bouwer, H. and Rice, R. C., 1976, A slug test for determining hydraulic conductivity of unconfined aquifers with completely or partially penetrating wells: Water Resources Research, vol. 12 no. 3, p. 423-428.
- Broomfield, C. S., and Crittenden, M. D., Jr., 1971, Geologic map of the Park City East quadrangle, Summit and Wasatch Counties, Utah: U.S. Geological Survey Geological Quadrangle Map GQ-852, scale 1:24,000.
- Chow, V. T., 1964, Handbook of applied hydrology: McGraw-Hill, New York.
- Cooper, H. H., Jr., Bredehoeft, J. D., and Papadopoulos, I. S., 1967, Response of a finite-diameter well to an instantaneous charge of water: Water Resources Research vol. 3, no.1, p. 263-269.
- Crittenden, M. D., Jr., Calkins, F. C., and Sharp, B. J., 1966, Geologic map of the Park City West quadrangle, Utah: U.S. Geological Survey Geological Quadrangle Map GQ-535, scale 1:24,000.
- Fenneman, N. M., 1931, Physiography of the Western United States: New York, N.Y., McGraw-Hill, 534 p.
- Holmes, W. F., Thompson, K. R., and Enright, M., 1986, Water resources of the Park City area, Utah with emphasis on ground water: Utah Department of Natural Resources Technical Publication No. 85, 81 p.

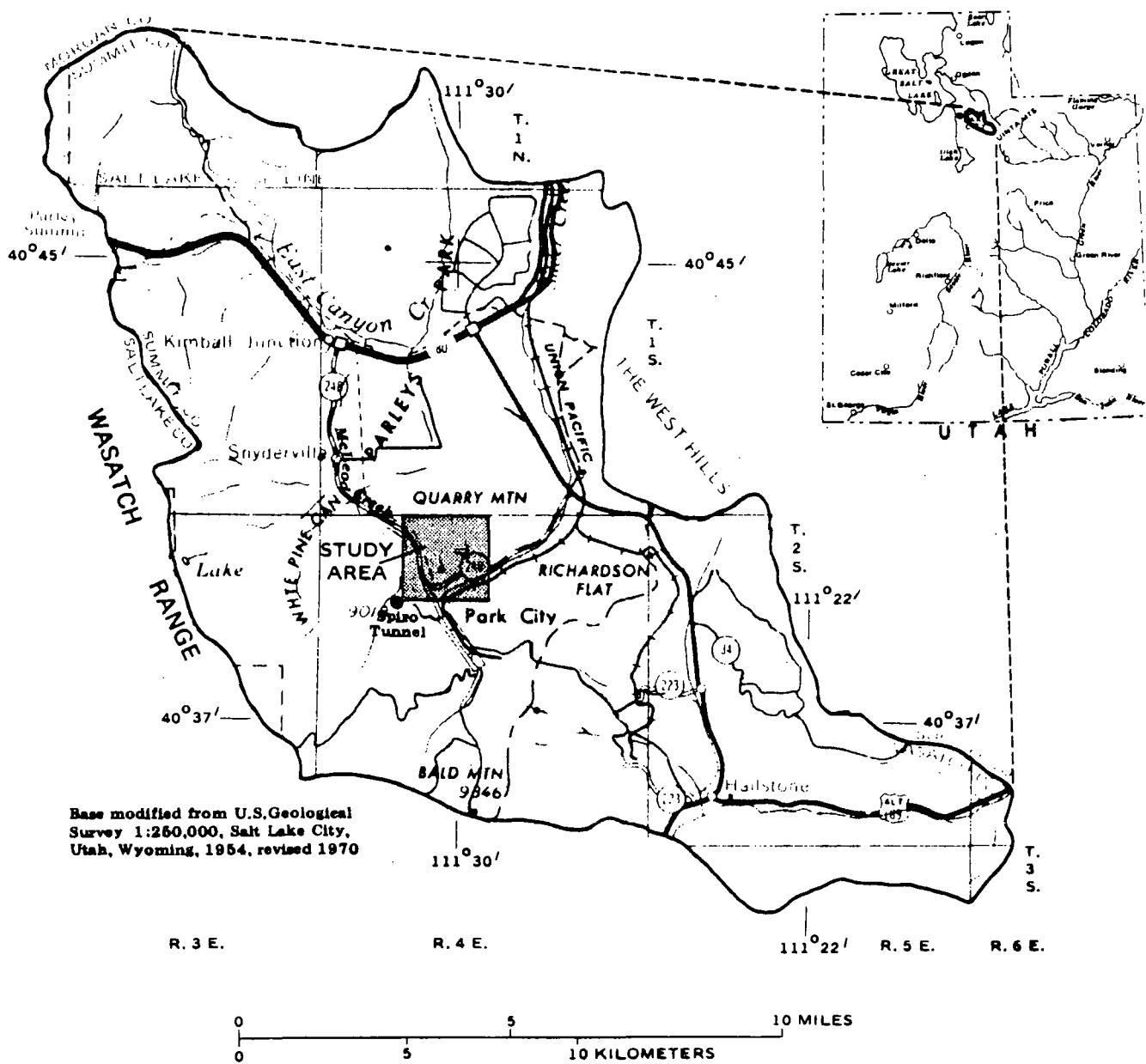


Figure 1.--Location of study area.

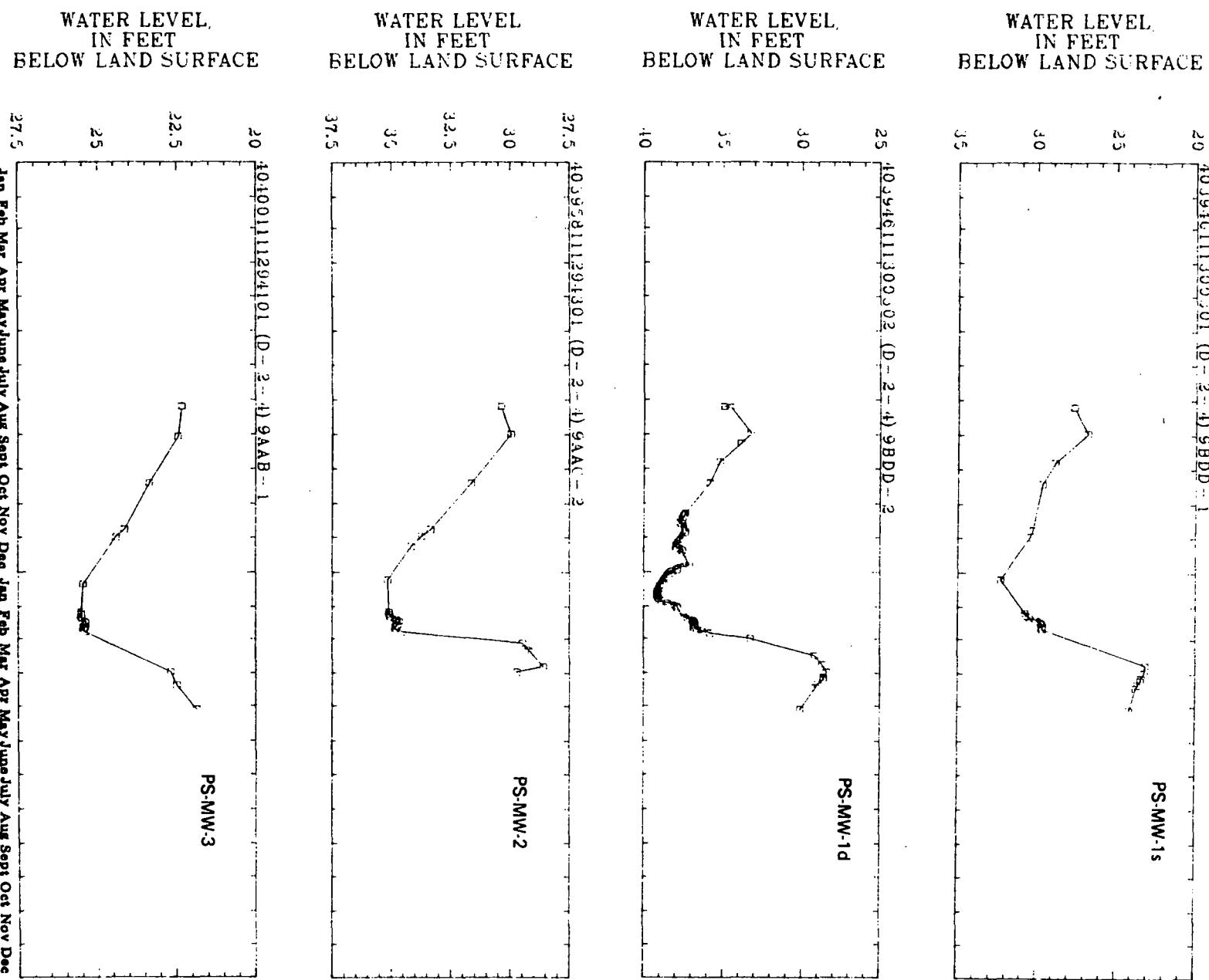


Figure 5.--Seasonal water-level fluctuations in observation wells.

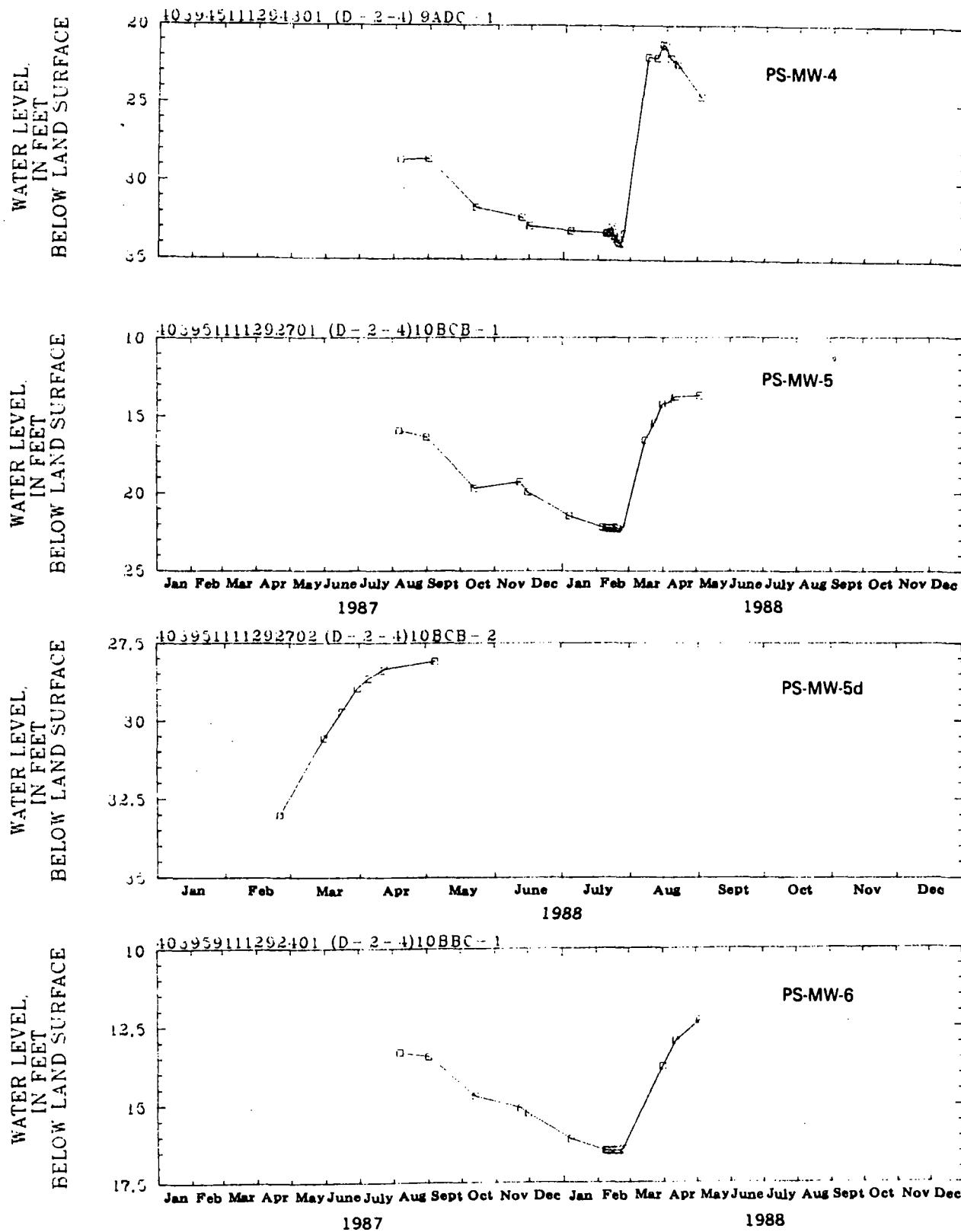


Figure 5.--Seasonal water-level fluctuations in observation wells--Continued.

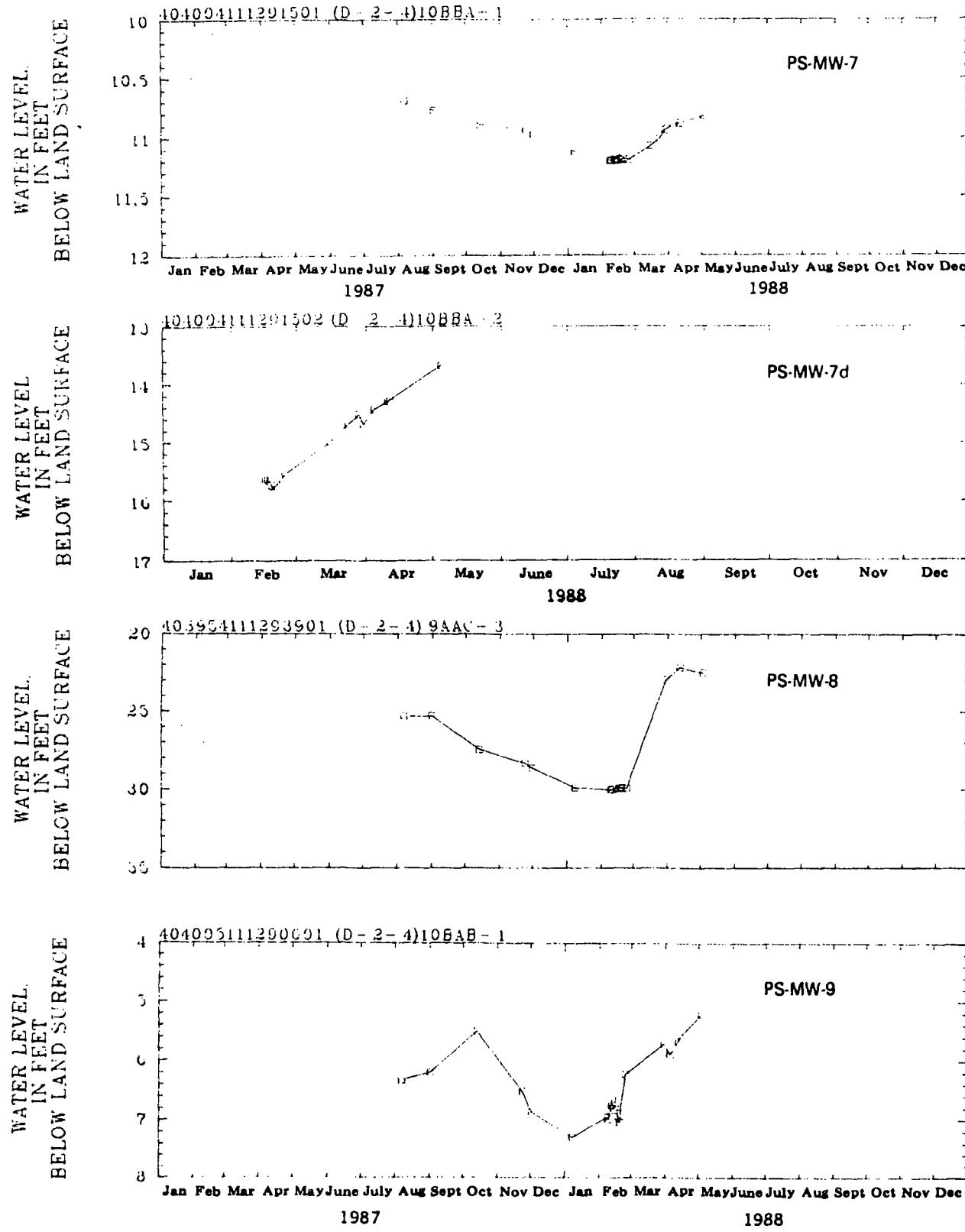


Figure 5.--Seasonal water-level fluctuations in observation wells--Continued.

## EXPLANATION

- WELL
- DRAIN

— — — TAILINGS POND--As shown on  
U.S. Geological Survey Park  
City East, 1:24,000, 1955

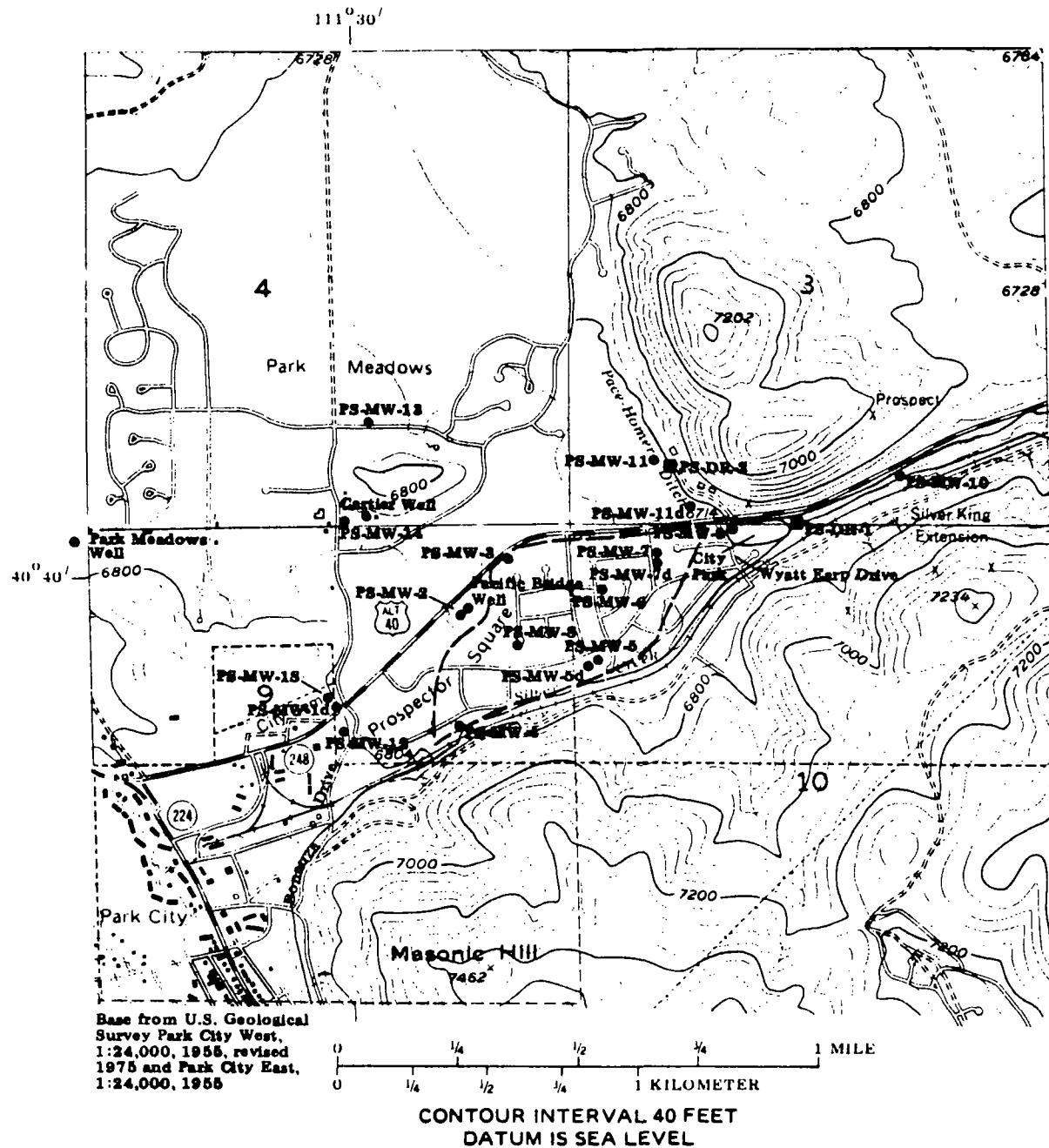


Figure 2a.--Location of ground-water sites in Prospector Square area, Summit County, Utah.

## EXPLANATION

▲ WATER-QUALITY DATA-COLLECTION SITE

▼ AQUIFER-INTERFERENCE TEST  
DATA-COLLECTION SITE

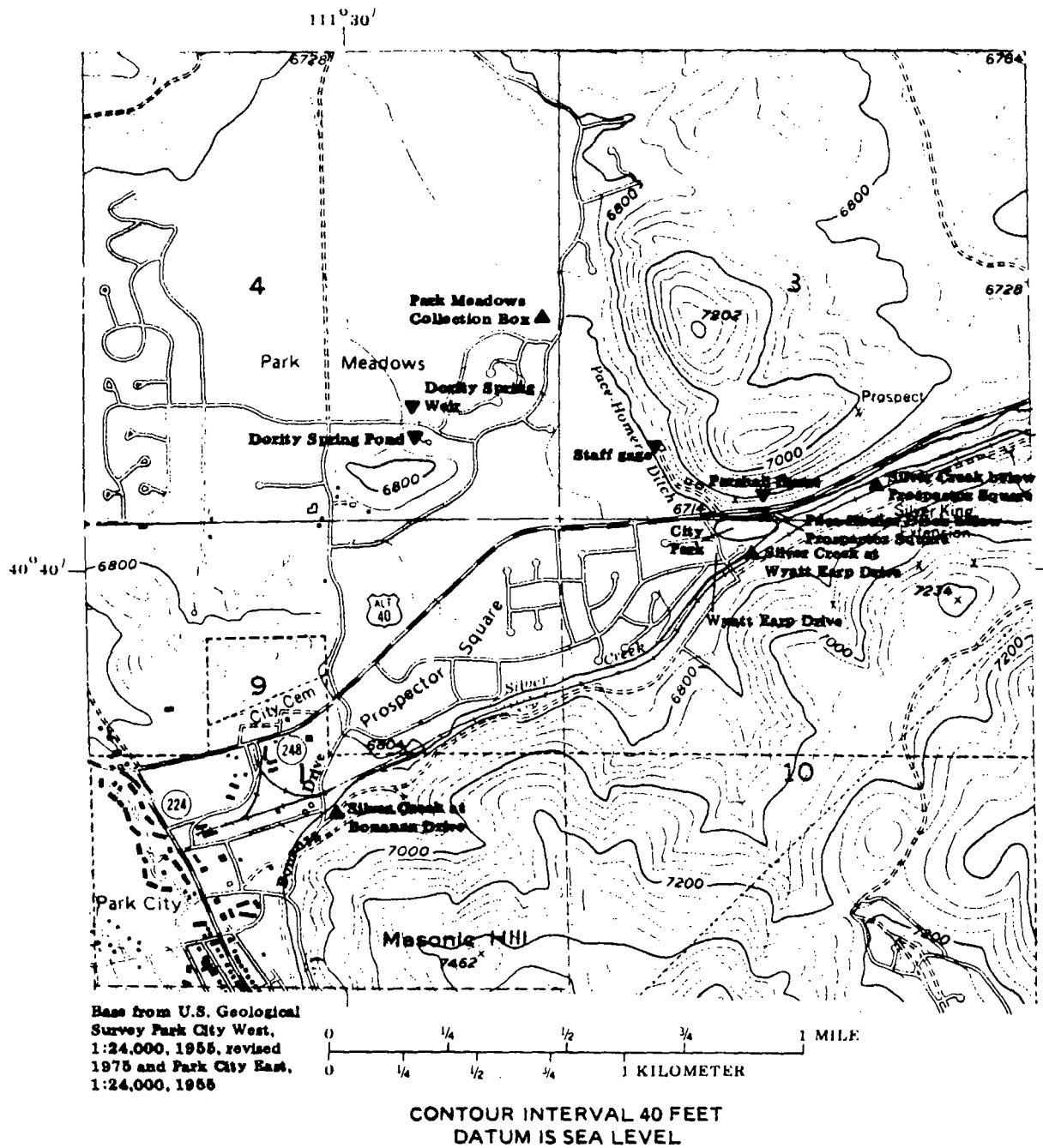


Figure 2b.--Location of surface-water data-collection sites in Prospectors Square area, Summit County, Utah.

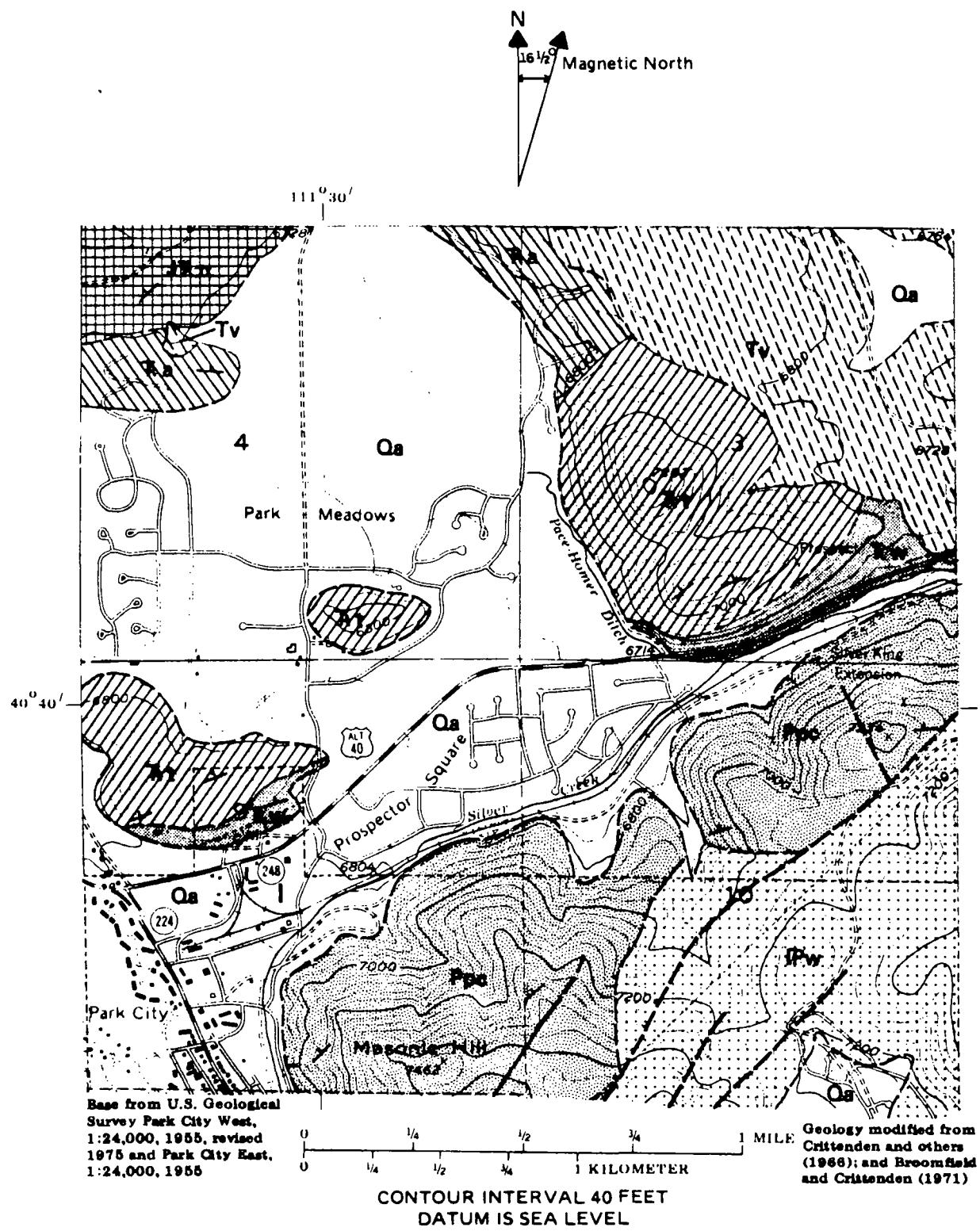


Figure 3.--Generalized geology of the Prospectors Square area, Summit County, Utah.

## EXPLANATION

QUATERNARY	{	Qa	ALLUVIAL DEPOSITS—Poorly sorted mixture of material ranging in size from clay to boulders. Beds appear to be lenticular and discontinuous
TERTIARY	{	Ww	IGNEOUS ROCKS—Primarily extrusive igneous rocks, chiefly andesitic pyroclastics with some intercalated flow rocks
JURASSIC	{	██████	NUGGET SANDSTONE—Pale-orange, medium-grained, cross-bedded sandstone
TRIASSIC	{	▨▨▨▨	ANKAREH FORMATION—Reddish-brown, reddish-purple, or bright-red shale, mudstone, and sandstone in upper and lower parts. Massive, cross-bedded, white to pale-purple, coarse-grained to pebbly quartzite in middle part
	{	▨▨	THAYNES FORMATION—Brown-stained, fine-grained limy sandstone and siltstone interbedded with olive-green to dull-red shale and gray, fine-grained, fossiliferous limestone
	{	Tw	WOODSIDE SHALE—Dark-red or purplish-red shale
PERMIAN	{	Ppc	PARK CITY FORMATION—Pale-gray-weathering fossiliferous and cherty limestone containing a medial phosphatic shale member
PENNSYLVANIAN	{	IPw	WEBER QUARTZITE—Pale-gray, tan-weathering quartzite and limy sandstone with some interbedded gray to white limestone and dolomite
— — — — CONTACT—Dashed where approximately located			
— — — — HIGH-ANGLE FAULT—Dashed where approximately located			
↙ STRIKE AND DIRECTION OF DIP OF BEDS			

## EXPLANATION

— 6760 — WATER-TABLE CONTOUR—Shows altitude of the water table. Dashed where approximately located. Contour interval 10 feet. Datum is sea level

### OBSERVATION WELL

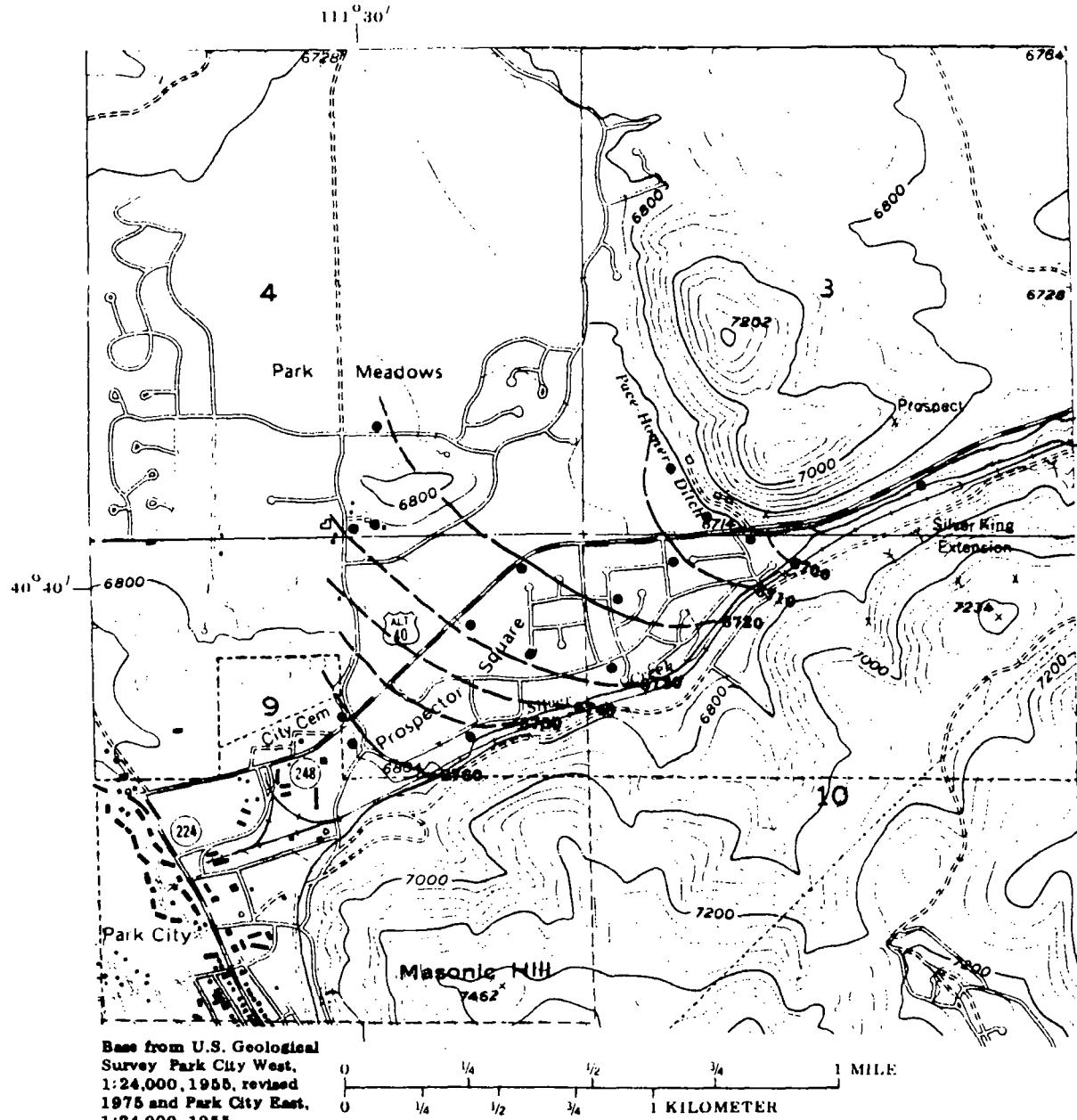


Figure 4.—Map of the Prospectors Square area showing the water table in the shallow unconsolidated valley-fill aquifer, April 1988.

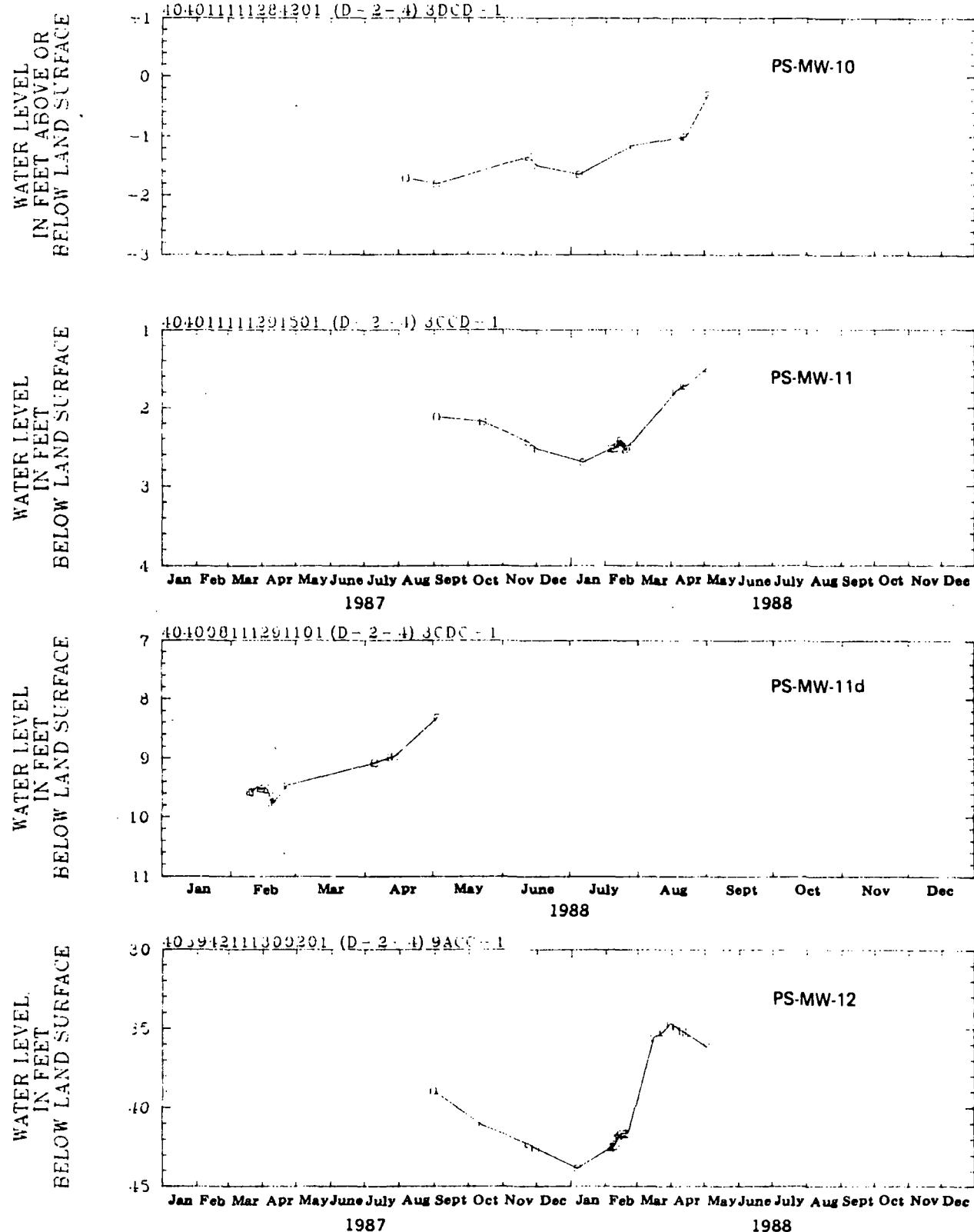


Figure 5.--Seasonal water-level fluctuations in observation wells--Continued.

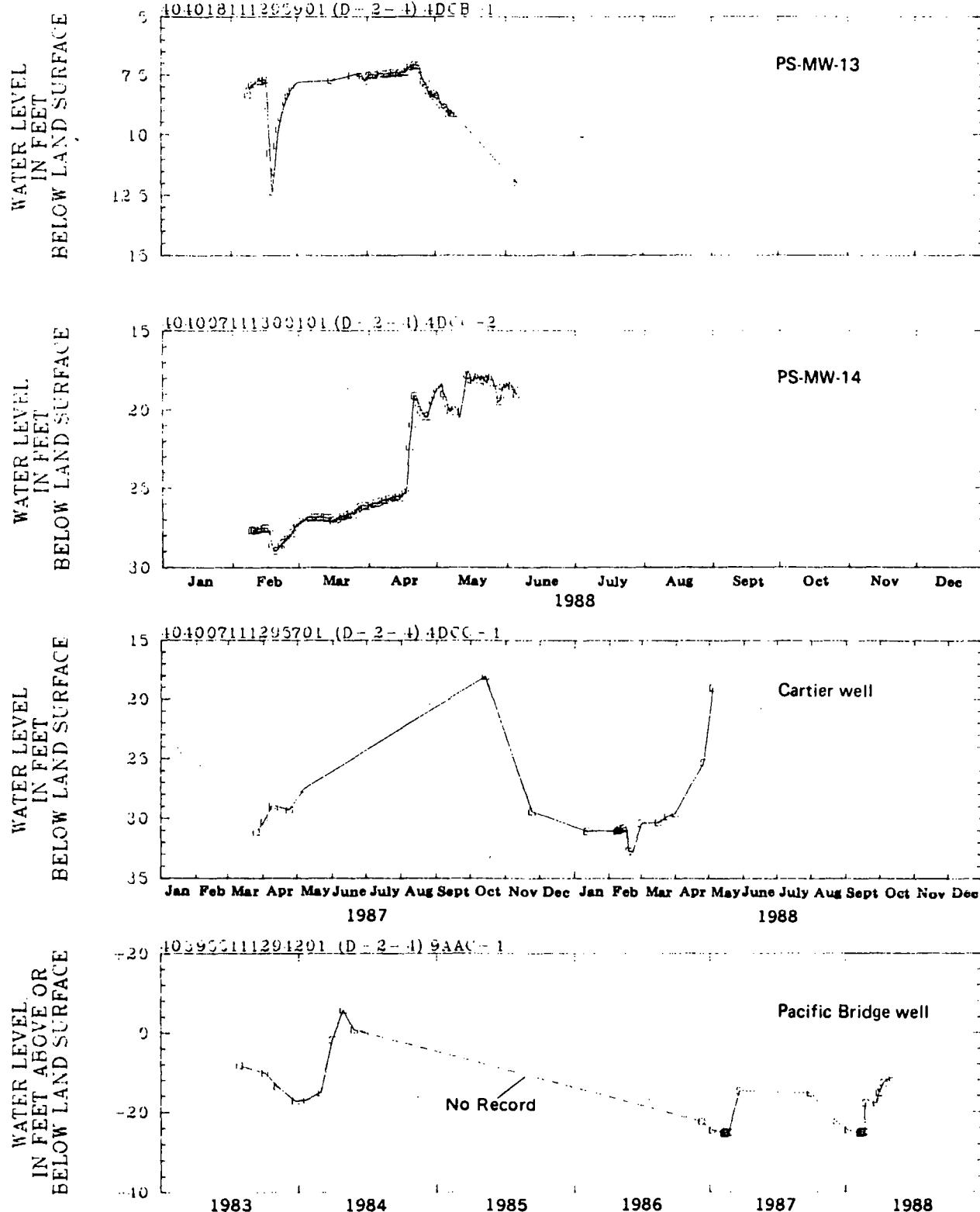


Figure 5.--Seasonal water-level fluctuations in observation wells--Continued.

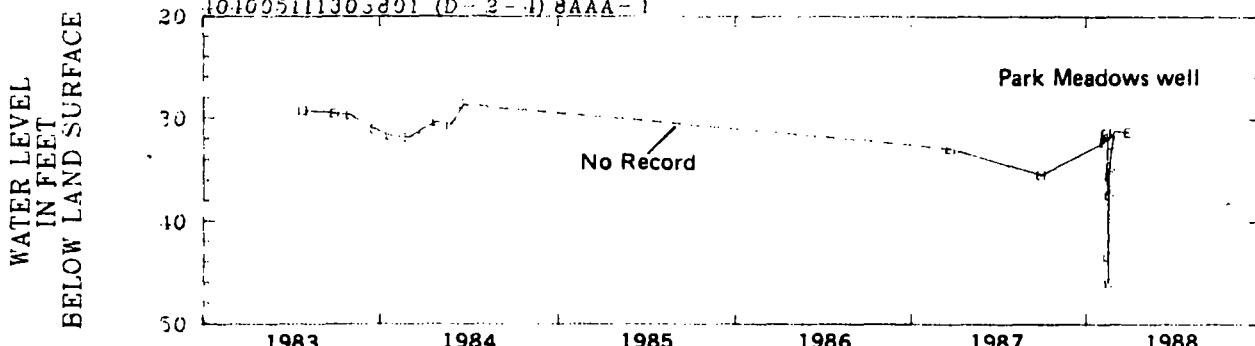
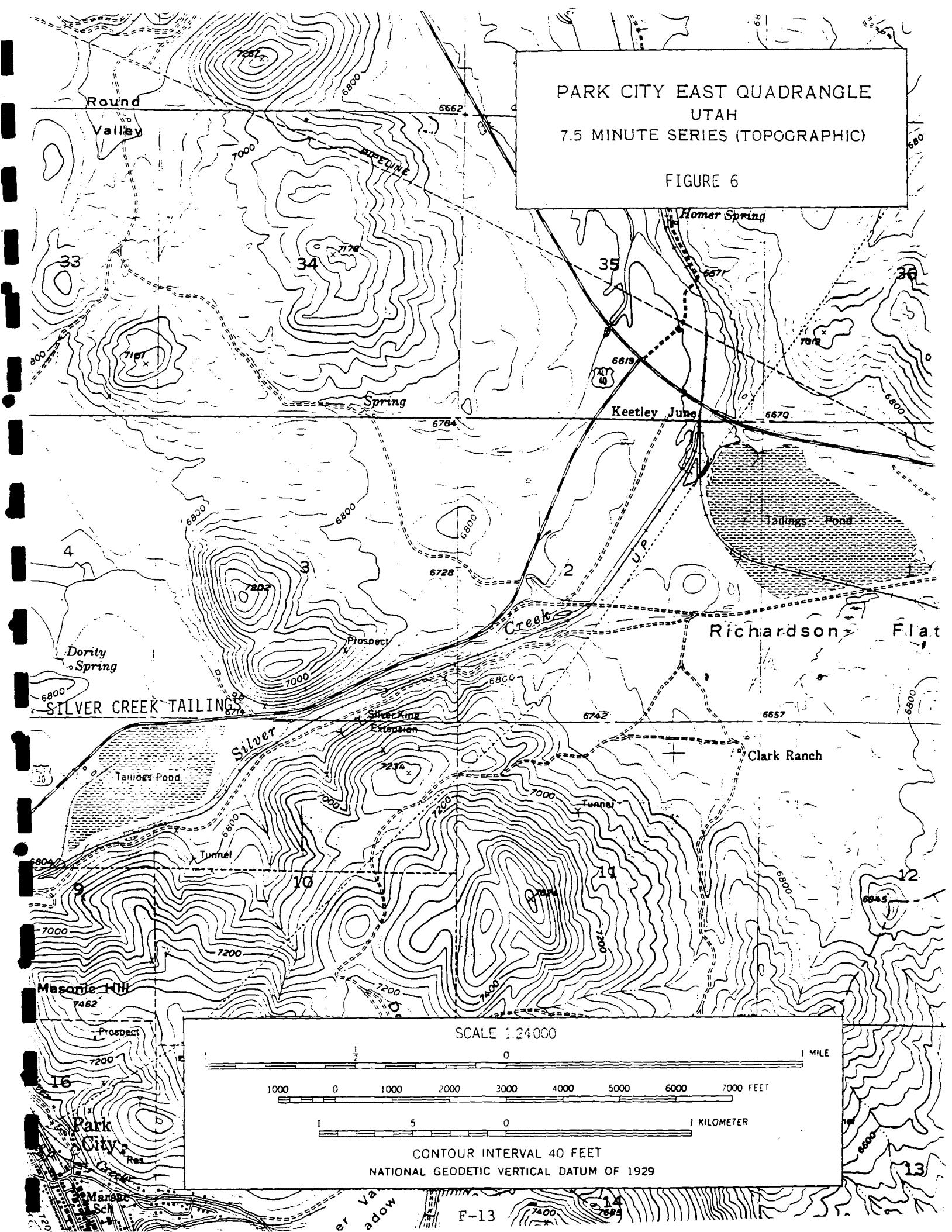


Figure 5.--Seasonal water-level fluctuations in observation wells--Continued.

PARK CITY EAST QUADRANGLE  
UTAH  
7.5 MINUTE SERIES (TOPOGRAPHIC)

FIGURE 6



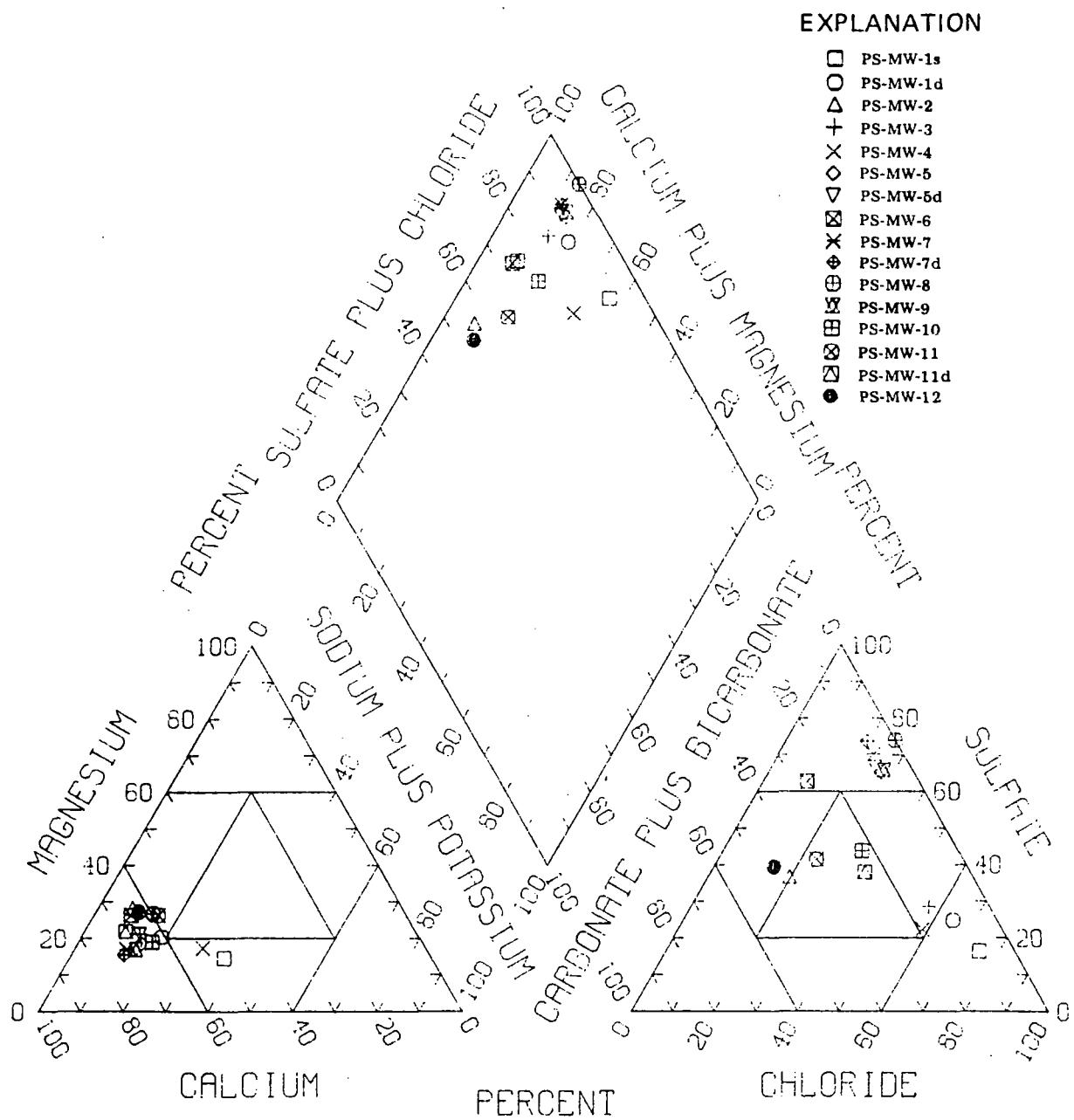


Figure 7.--Chemical composition of water from monitoring wells completed in the unconsolidated valley fill.

**Table 1.--Selected data for 3 observation wells and 18 monitoring wells**

Altitude of land surface: Surveyed altitudes given in feet and decimal fractions; altitudes interpolated from U.S. Geological Survey topographic maps given to nearest foot.

Screened interval: Upper and lower limits of screen given in feet below land surface, P indicates perforated casing.

Production interval: Upper and lower limits of the well that are open to the aquifer material, given in feet below land surface.

Principal water-bearing unit: Trt, Thaynes Formation; Trw, Woodside Shale; Qa, unconsolidated valley fill.

Tailings interval: Upper and lower limits of tailings given in feet below land surface.

Other available data: C, water-quality data in table 9; L, lithologic logs in table 2; and W, water-level data in table 3.

Well identifier	Depth of borehole (feet)	Altitude of land surface (feet)	Screened interval (feet)	Production interval (feet)	Principal water-yielding unit	Tailings interval (feet)	Other available data
<b>OBSERVATION WELLS</b>							
Park Meadows Well	320	6,751.75	100-113(P)	100-165	Trt	--	L,W
Pacific Bridge Well	446	6,759.73	300-446(P)	300-446	Trw	--	L,W
Cartier Well	33	6,750.22	--	--	Qa	--	L,W
<b>MONITORING WELLS</b>							
PS-MW-1s	47.0	6,791.87	35.0-40.0	32.5-45.5	Qa	--	C,L,W
PS-MW-1d	85.5	6,791.06	70.0-80.0	62.0-80.0	Qa	--	C,L,W
PS-MW-2	44.5	6,758.44	33.0-38.0	29.0-44.5	Qa	--	C,L,W
PS-MW-3	36.0	6,743.35	25.5-30.5	19.0-35.5	Qa	1.0-2.0	C,L,W
PS-MW-4	45.0	6,773.42	34.0-39.0	17.0-45.0	Qa	--	C,L,W
PS-MW-5	33.0	6,741.04	23.0-28.0	20.0-33.0	Qa	0.6-1.4 4.5-9.0	C,L,W
PS-MW-5d	95.5	6,741.99	83.0-93.0	81.0-95.0	Qa	do	C,L,W
PS-MW-6	29.0	6,731.48	19.0-24.0	14.0-29.0	Qa	--	C,L,W
PS-MW-7	25.5	6,722.46	15.5-20.5	11.5-25.5	Qa	--	C,L,W
PS-MW-7d	138.0	6,722.59	120.0-130	116.0-134.0	Qa	--	C,L,W
PS-MW-8	40.5	6,751.41	28.5-33.5	19.5-40.0	Qa	--	C,L,W
PS-MW-9	16.5	6,707.90	8.5-13.5	5.0-15.5	Qa	1.5-2.0 2.4-3.5	C,L,W
PS-MW-10	13.0	6,680	6.0-11.0	4.9-11.5	Qa	--	C,L,W
PS-MW-11	21.5	6,711.19	10.0-15.0	3.5-20.0	Qa	--	C,L,W
PS-MW-11d	85.0	6,715.89	69.8-79.8	66.0-79.8	Qa	--	C,L,W
PS-MW-12	125	6,797.70	110.0-120.0	98.5-120.0	Qa	--	C,L,W
PS-MW-13	61.0	6,728.42	41.0-51.0	38.0-52.0	Qa	--	C,L,W
PS-MW-14	75.0	--	48.5-58.5	43.0-63.5	Qa	--	C,L,W

<sup>1</sup> Although the completed well was originally 300 feet deep, a recent televIEWER log shows that the borehole wall has caved in the uncased part of the well below a depth of 113 feet.

Table 2.--Lithologic logs of 2 observation wells and 18 monitoring wells

Altitude of land surface: Alt., in feet above sea level.  
 Thickness in feet.  
 Depth in feet below land surface.

Location and material	Thickness	Depth	Location and material	Thickness	Depth
<b>OBSERVATION WELLS</b>					
Park Meadows Well (D-2-4) 8aaa-1 Alt. 6,517.75 feet. Log by Dave's Drilling			PS-MW-1s (D-2-4)9bdd-1--Continued		
Clay.....	10	10	Gravel, with interbedded clay and sand.....	6	36
Sand and gravel.....	30	40	Clay, moderate brown, inter- bedded sand, intermittent thin layers of cobbles .....	3	39
Clay.....	10	50	Gravel, with interbedded clay and sand.....	8	47
Sand and gravel.....	10	60			
Clay.....	10	70			
Sand and gravel.....	10	80			
Cobbles.....	10	90			
Shale, reddish.....	40	130			
Shale, reddish, mixed with limestone, gray.....	50	180			
Limestone, gray, mixed with shale, reddish.....	40	220	PS-MW-1d (D-2-4)9bdd-2		
Limestone, gray.....	80	300	Alt. 6,791.06 feet.		
Unknown.....	20	320	Lithology similar to PS-MW-1s for first 45 feet.		
			Clay, moderate brown, interbedded sand, fine to coarse, minor amount of gravel, high plasticity.....	5	50
			Clay, as above but low to medium plasticity.....	1	51
			Sand, fine to coarse, with clay and gravel.....	3	54
			Cobbles, with clay and sand... Sand, fine to coarse, with interbedded clay and some gravel.....	1	55
Pacific Bridge Well (D-2-4)9aac-1 Alt. 6,758.53 feet. Log by Larry W. Dayton			Clay, moderate brown, with interbedded sand and numerous cobbles.....	7	62
Sand and gravel.....	5	5	Clay, moderate brown, with interbedded sand and some gravel, few cobbles.....	7	69
Sand.....	4	9	Clay, as above, high plasticity.....	5	78
Clay and gravel.....	57	66	Clay, as above, decreasing plasticity with increasing depth.....	2	83
Gravel, loose, some water.....	4	70	Bedrock, silty shale, reddish brown.....	0.5	85
Clay and gravel.....	95	165			
Clay, fine gravel, and quartzite.....	10	175			
Clay.....	25	200	PS-MW-2 (D-2-4)9acc-2		
Clay and gravel.....	10	210	Alt. 6,758.44 feet.		
Gravel, loose, some water.....	5	215	Fill, silt, sand, gravel, light brown.....	2.5	2
Clay and quartzite.....	45	260	Silty sand, light brown,.5 small amount of clay.....	2	4
Shale, red.....	35	295	Sandy clay, dark brown,.5 intermittent gravel, 30 percent.....	2.5	7
Shale, red, some water.....	20	315	Gravel, cobbles, up to 4 inches, 30 percent silty sand, moderate brown.....	3.5	10
Shale, red, quartzite and gravel.....	45	360	Sand, gravel, moderate brown,.5 intermittent cobble layers....	3.5	14
Lime, hard, quartzite and shale.....	5	365	Clay, moderate brown, silt and sand present, intermittent cobble layers.....	7.5	21
Shale, red, quartzite.....	60	425	Clay, silty, light to.5 moderate brown, medium plasticity, sand and gravel present, unsorted.....	9.5	31
Shale, red, sulfur odor.....	7	432	Clay, moderate brown, medium plasticity, fine sand present.....	4	35
Shale, red, quartzite, gravel..	13	445			
Bedrock, very hard.....	1	446			
<b>MONITORING WELLS</b>					
PS-MW-1s (D-2-4)9bdd-1 Alt. 6,791.87 feet.					
Fill, dark brown, soil mixed with sand and gravel.....	3	3			
Clay, moderate brown, with interbedded sand and gravel, intermittent cobbles.....	10	13			
Clay, silty, moderate brown, intermittent layers of gravel and cobbles.....	5	18			
Cobbles, with interbedded clay and sand.....	1	19			
Clay, moderate brown, interbedded with sand and gravel.....	5	24			
Clay, moderate brown, interbedded sand and gravel, intermittent layers of cobbles.....	6	30			

Table 2.--Lithologic logs of 2 observation wells and 18 monitoring wells--Continued

Location and material	Thickness	Depth	Location and material	Thickness	Depth
<b>PS-MW-2 (D-2-4)9acc-2--Continued</b>			<b>PS-MW-4 (D-2-4)9adc-1--Continued</b>		
Gravel, coarse sand, angular....	1	36	Clay, moderate brown, tight in some layers, fine sand, intermittent cobble layers....	8	39
Clay, moderate brown, with fine to medium sand, high plasticity, intermittent, thin cobble layers .....	8.5	44.5	Sand, medium to coarse, poorly sorted, gravel present, interbedded clay....	6	45
<b>PS-MW-3 (D-2-4)9aab-1</b>			<b>PS-MW-5 (D-2-4)10BCB-1</b>		
Alt. 6,743.35 feet.			Alt. 6,741.04 feet.		
Topsoil.....	1	1	Topsoil, silty sand, moderate brown.....	0.5	0.5
Sand, light brown, medium- grained, well sorted.....	2	3	Sand, light tan, medium- grained, well sorted.....	1	1.5
Clay, moderate brown, minor amount of sand and gravel, low plasticity.....	3	6	Sand, moderate brown, fine- to medium-grained, some gravel...	2.5	4
Cobbles, with clay and sand, moderate brown.....	6	12	Clay, moderate brown, sand, fine to medium, gravel.....	0.5	4.5
Clay, moderate brown, with fine sand, minor amount of cobbles.....	3	15	Sand, light tan, medium to coarse.....	4.5	9
Clay, moderate brown, fine sand.....	1.5	16.5	Sand, moderate brown, interbedded silty clay, some cobbles present.....	3.5	12.5
Clay, moderate brown, with fine sand, intermittent gravel, rounded to angular....	9.5	26	Clay, moderate brown, some silt, gravel in upper foot....	2.5	15
Clay, moderate brown, with fine sand, medium to high plasticity, some gravel.....	9	35	Clay, moderate brown, with minor amount of interbedded coarse sand, intermittent thin gravel layers.....	9.5	24.5
Gravel, with clay and fine sand.....	1	36	Clay, moderate brown, with interbedded fine sand, intermittent gravel layers....	3.5	28
<b>PS-MW-4 (D-2-4)9adc-1</b>			Clay, moderate brown, with fine to medium sand, high plasticity.....	6	34
Alt. 6,773.42 feet.			<b>PS-MW-5d (D-2-4)10bcb-2</b>		
Sand, light brown, fine to coarse, well rounded, minor amount of gravel.....	0.5	0.5	Alt. 6,741.99 feet.		
Clay, dark brown, with minor amount of gravel, thin sand layer.....	4	4.5	No lithologic log of initial 34 feet. Refer to log of PS-MW-5.....	34	34
Gravel, with sandy clay, medium plasticity, intermittent thin sand layers.....	5.5	10	Clay, reddish-brown, matrix mixed with fine to coarse sand, angular to subangular...	1.5	35.5
Clay, red-brown, medium plasticity, with fine to medium sand, intermittent pebbles.....	3	13	No data.....	8.5	44
Gravel, fine to coarse, angular, minor amount of fine sand.....	2	15	Clay, gravel, sand, poorly sorted, 60 percent clay, 25 percent gravel, and 15 percent sand, clay reddish-brown, sand medium to coarse, angular to subangular.....	1.5	45.5
Clay, red-brown, with fine to medium sand and intermittent quartz pebbles.....	1	16	No data.....	8.5	54
Gravel and cobbles, angular to subrounded, with minor amount of fine sand.....	3.5	19.5	Clay, silty, with sand and gravel, poorly sorted, large rock fragment.....	1.5	55.5
Gravel and cobbles, with minor amount of clay, moderate brown, fine sand....	1	20.5	No data.....	8.5	64
Cobbles (minimal recovery)....	2.5	23	Clay, reddish-brown, very fine silt within matrix, clay tight, intermixed rock fragments.....	1.5	65.5
Clay, moderate brown, with fine sand and gravel.....	1.5	24.5	No data.....	13.5	79
Cobbles (minimal recovery)....	1.5	26			
Clay, moderate brown, with fine sand and gravel.....	5	31			

Table 2.--Lithologic logs of 2 observation wells and 18 monitoring wells--Continued

Location and material	Thickness	Depth	Location and material	Thickness	Depth
<b>PS-MW-5d (D-2-4)10bcb-2--Continued</b>					
Clay and gravel, clay reddish-brown, intermixed with angular to subangular fragments, 0-1 inch, possible Woodside Shale.....	1.5	80.5	PS-MW-7d (D-2-4)10bba-2--Continued		
No data.....	13.5	94	Clay, sandy, brown.....	3.5	45
Clay, silty, reddish-brown, low plasticity.....	0.5	94.5	Clay, brown, with sand and gravel.....	1.5	46.5
Gravel, medium to coarse, graded toward top of sample (may not be representative of aquifer material).....	1	95.5	Clay, sandy, brown.....	4.5	51
<b>PS-MW-6 (D-2-4)10bbc-1</b>			Clay, sand, gravel, unsorted...	4	55
Alt. 6,731.48 feet.			Clay, sand, gravel, poorly sorted, angular to subangular, about 10 percent clay.....	1.5	56.5
Topsoil, moderate to dark brown.....	1.5	1.5	Clay, sand, gravel, unsorted...	8.5	65
Sand, moderate brown, silt, and gravel, poorly sorted, some cobbles.....	11.5	13	Clay, sand, gravel, with some cobbles, poorly sorted, with quartzite clasts.....	1.5	66.5
Clay, moderate brown, with interbedded fine sand and gravel.....	16	29	Clay, sand, gravel, poorly sorted.....	8.5	75
<b>PS-MW-7 (D-2-4)10bba-1</b>			Clay, sand, gravel, cobbles, poorly sorted, with silty shale and sandstone fragments, clay about 10 percent.....	1.5	76.5
Alt. 6,722.46 feet.			Clay, sand, gravel, poorly sorted.....	8.5	85
Topsoil, dark brown.....	0.5	0.5	Clay, sand, gravel, cobbles, red-brown to yellow-brown, clay also dark green/brown and gray, poorly sorted, subangular to subrounded, sandstone, quartzite, and rock fragments.....	1.5	86.5
Sand, silt, clay, moderate brown, with interbedded pebbles.....	5.5	6	Clay, sand, gravel, poorly sorted.....	8.5	95
Sand and gravel, light tan, unsorted.....	1	7	Clay, sand, gravel, interbedded and mixed, red-brown, clay sandy and hard, sand, medium to coarse, poorly sorted, subangular to subrounded.....	1.5	96.5
Sandy clay, moderate brown, interbedded gravel.....	2	9	Clay, sand, gravel, poorly sorted.....	3.5	100
Clay, sandy, moderate brown, numerous interbedded cobbles..	7	16	Clay, gray with yellow streaks, hard, imbedded quartzite and sandstone rock fragments, some brown and black carbonaceous material in clay.....	1.5	101.5
Clay, moderate brown, interbedded gravel and sand...	9.5	25.5	Clay, sand, gravel, poorly sorted.....	8.5	110
<b>PS-MW-7d (D-2-4)10bba-2</b>			Clay, sand, gravel, cobbles, red-brown, soft clay, sand, medium to coarse, poorly sorted, quartzite rock fragments.....	1.5	111.5
Alt. 6,722.59 feet.			Clay, sand, gravel, poorly sorted.....	3.5	115
Log by D. Coker.			Clay, sandy.....	5	120
No lithologic log of initial 30 feet. Refer to log of PS-MW-7 located 5 feet to the north.....	25.5	25.5	Clay, brown with yellow and pink, medium stiffness, silty.....	1.5	121.5
Sand, very fine to fine, angular to subangular, some interbedded coarse gravel, with 10 percent clay matrix...	1.5	27	Clay, sandy.....	8.5	130
Sand and clay, unsorted.....	8	35	Gravel, sand, clay.....	5	135
Clay, red-brown to gray, soft to hard, with black streaks of carbonaceous material, intermittent layers with clay and sand, medium to coarse, subangular to rounded, unsorted.....	1.5	36.5	Gravel, fine pebbles, well sorted, subangular to subrounded, a few rock fragments (may not be representative).....	1.5	136.5
Clay, some sand, unsorted.....	3.5	40	Gravel, sand, clay.....	1.5	138
Sand, fine to medium, angular to subangular, some rock fragments, and gravel increasing in size with depth, some sandy clay, 5 to 10 percent.....	1.5	41.5			

Table 2.--Lithologic logs of 2 observation wells and 18 monitoring wells--Continued

Location and material	Thickness	Depth	Location and material	Thickness	Depth
<u>PS-MW-8 (D-2-4)9aac-3</u> Alt. 6,751.41 feet.			<u>PS-MW-10 (D-2-4)3dcd-1--Continued</u>		
Topsoil, dark brown.....	0.5	0.5	Gravel, fine to coarse, poorly sorted.....	1.5	11.5
Sand, silty, moderate brown, with minor amount of interbedded gravel.....	4	4.5	Bedrock, shale, dark reddish brown, weathered, parts easily.....	1.5	13
Clay, dark brown, with interbedded fine sand.....	0.5	5			
Gravel, cobbles, some sand and silt.....	6.5	11.5	<u>PS-MW-11 (D-2-4)3ccd-1</u>		
Clay, silty, moderate brown, minor amount of interbedded coarse sand, medium plasticity.....	2.5	14	Alt. 6,711.19 feet.		
Gravel.....	1	15	Fill, sand, silt, gravel, dry, loose.....	2	2
Clay, moderate brown, with interbedded sand and gravel...	1.5	16.5	Clay, dark brown to black, organic, low to medium plasticity.....	6	8
Gravel, with sand and clay....	0.5	17	Clay, dark gray to black, with some interbedded gravel, medium to high plasticity....	2	10
Clay, silty, moderate brown....	1	18	Sand, moderate brown, fine- to medium-grained, some gravel...	0.5	10.5
Gravel, with sand and clay....	2	20	Sand, silty, with some gravel, reddish-orange color.....	5.5	16
Sand, silty, moderate brown, some clay, low plasticity, interbedded gravel.....	10	30	Clay, dark gray, low plasticity.....	1	17
Sand, coarse, gravel, minor amount of clay and fine sand..	10.5	40.5	Gravel, with silt and sand....	3	20
			Sand, gravel, with some gray-green clay.....	1.5	21.5
<u>PS-MW-9 (D-2-4)10bab-1</u> Alt. 6,707.90 feet.			<u>PS-MW-11d (D-2-4)3cdc-1</u>		
Topsoil, dark brown.....	1	1	Alt. 6,715.89 feet..		
Gravel, with sand, coarse.....	0.5	1.5	Log by K. Moll and D. Coker.		
Sand, light tan, fine- grained, well sorted, mineralized.....	0.5	2	Soil, clayey, silty.....	1.5	1.5
Clay, moderate brown, with interbedded sand, fine to medium.....	0.5	2.5	Gravel, sand.....	2.5	4
Sand, light tan, fine- grained, well sorted, highly mineralized.....	1.5	4	Clay, silty, with 4-inch layer of decomposed straw....	2	6
Clay, dark brown, organic material present, low plasticity.....	2.5	6.5	Gravel, with very fine sand....	4	10
Gravel, cobbles, with interbedded sandy clay.....	3	9.5	Gravel, coarse, with very fine sand and silt, poorly sorted, rounded to subrounded, quartz, feldspar, and shale rock chips.....	1.5	11.5
Gravel, interbedded sandy clay.....	2.5	12	Silt, dark brown, with gravel and very fine to fine sand....	3.5	15
Clay, moderate brown, interbedded fine sand and some gravel, high plasticity..	3	15	Clay, dark gray, sticky, very plastic, and gravel, coarse, angular to subrounded, poorly sorted.....	1.5	16.5
Clay, reddish brown, with fine sand and angular rock fragments.....	0.5	15.5	Clay, gravel, poorly sorted....	2	18.5
Bedrock, angular fragments, red silty shale, friable.....	1	16.5	Clay, stiff.....	1.5	20
			Clay, dark gray, no plasticity, very stiff.....	1.5	21.5
<u>PS-MW-10 (D-2-4)3dcd-1</u> Alt. 6,680 feet.			Clay, dark gray, stiff.....	5.5	27
Sand, fine to coarse, some gravel.....	1	1	Sand, fine to coarse, sorted...	3	30
Soil, dark brown, organic material.....	0.5	1.5	Sand, light brown, very fine to coarse, subangular to subrounded, well sorted.....	1.5	31.5
Sand, fine to coarse, with silty sand lenses and gravel..	3.5	5	Sand, coarse, with gravel.....	7.5	39
Gravel, fine to coarse, poorly sorted.....	1	6	Gravel, coarse.....	1	40
Sand, fine to coarse, poorly sorted, with silty sand lenses and gravel.....	4	10	Gravel, very coarse to cobbles, angular to rounded, sorted....	1.5	41.5
			Gravel, coarse.....	5.5	47
			Clay, silty.....	3	50
			Clay, light brown, silty, tight.....	1.5	51.5
			Clay, silty.....	3.5	55
			Sand, light brown, coarse, with gravel, silt 30 percent, and quartz pebbles.....	1.5	56.5

Table 2.--Lithologic logs of 2 observation wells and 18 monitoring wells--Continued

Location and material	Thickness	Depth	Location and material	Thickness	Depth
<u>PS-MW-11d (D-2-4)3cdc-1--Continued</u>			<u>PS-MW-13 (D-2-4)4dcb-1</u>		
Sand, with gravel.....	8.5	65	Alt. 6,728.42 feet.		
Clay, red-brown, tight, with coarse gravel.....	1.5	66.5	Clay, silty, red-brown, with gravel.....	5	5
Clay, with gravel.....	1.5	68	Clay, medium brown, moist.....	7	12
Sand, light brown, silty, small amount of clay.....	7	75	Clay and gravel, unsorted, with cobbles 2-3 inches in length, subangular.....	8	20
Sand, light brown, fine to medium.....	1.5	76.5	Clay, light brown, silty, low to medium plasticity, and sand, fine to very fine, iron staining present.....	1.5	21.5
Sand, silty.....	3.5	80	Clay with some cobbles 1-2 inches in length, poorly sorted, subangular to subrounded.....	7.5	29
Sand, light brown, well sorted, grades from fine at top to coarse at bottom split-spoon barrel (may be settling of material inside drill pipe)...	1.5	81.5	Clay, sand, gravel, poorly sorted.....	3	32
Sand, fine to coarse.....	3.5	85	Gravel, coarse to very coarse, subangular, with 30 percent sand and 10 percent clay.....	8	40
<u>PS-MW-12 (D-2-4)9acc-1</u>			Clay, medium brown, tight, with very fine sand and interbedded subangular gravel, iron staining present.....	1.5	41.5
Alt. 6,797.70 feet.			Clay, sand, gravel, unsorted, gravel increasing with depth..	12.5	54
Gravel, with silt and sand, moderate brown.....	2	2	Sand, gravel.....	1	55
Gravel, coarse, alternating with layers of sand and gravel.....	13	15	Limestone, light gray to white, massive, with weathered shale fragments.....	6	61
Gravel, cobbles, alternating with layers of interbedded clay, sand and gravel.....	10	25	Gravel, coarse, with clay and sand, limestone rock fragments.....	1.5	62.5
Clay, fine sand, moderate brown, some interbedded gravel.....	3	28	Gravel, with clay and sand....	6.5	69
Cobbles.....	1	29	Shale, purple, and limestone...	6	75
Clay, fine sand, moderate brown, some interbedded gravel.....	23	52			
Gravel, some sandy clay.....	2	54			
Clay, sandy, moderate brown, with some interbedded gravel, medium plasticity.....	9.5	63.5	<u>PS-MW-14 (D-2-4)4dcc-2</u>		
Clay, sand, fine to coarse, moderate brown, some gravel, high plasticity.....	2.5	66	Alt. 6,712.44 feet.		
Cobbles, sandy clay, moderate brown.....	1	67	Loam, dark brown.....	3	3
Clay, moderate brown, with interbedded sand and gravel, low plasticity.....	12	79	Gravel, with silt and sandy loam.....	4	7
Clay, moderate brown, with interbedded sand and gravel, high plasticity.....	6	85	Gravel.....	6	13
Cobbles, with interbedded clay, sand, and gravel, dense, moist.....	12	97	Gravel, with cobbles.....	9	22
Gravel, sand, fine to coarse, some cobbles, intermittent thin sandy clay layers.....	17	114	Clay, with 20-30 percent gravel.....	4	26
Gravel, sand, fine to coarse, igneous and quartzite boulders.....	6	120	Clay and gravel, unsorted, light brown, subangular clasts.....	11	37
Bedrock, silty shale, reddish-brown, friable.....	5	125	Gravel, sand, poorly sorted, quartz and siltsone rock fragments (split-spoon sample taken at 37 feet with no recovery).....	12	49
			Clay, medium brown, with coarse sand.....	11	60

Table 3.—Water levels in 3 observation wells and 18 monitoring wells

Descriptions of measuring points for each well are in the files of the U.S. Geological Survey

Water levels in feet above (+) or below land surface datum.

OBSERVATION WELLS

Park Meadows well (D- 2- 4) 8AAA- 1

Records available 1979 to current year (1988)

Date	Water level						
JUL 26, 1983	29.23	APR 26, 1984	30.35	FEB 11, 1988	31.46	FEB 18, 1988	45.92
SEPT 30	29.52	MAY 25	30.62	12	31.42	19	37.34
NOV 02	29.67	JUNE 20	28.66	13	31.43	20	35.48
DEC 21	31.03	MAR 23, 1987	32.86	14	31.38	21	34.52
JAN 20, 1984	31.71	SEPT 29	35.35	15	31.34	23	33.23
FEB 27	31.88	FEB 08, 1988	32.23	16	31.32	MAR 01	31.18
MAR 28	31.08	10	31.63	17	43.36	31	31.32

Pacific Bridge well (D- 2- 4) 9AAC- 1

Records available 1948 to current year (1988)

Date	Water level						
JUL 26, 1983	8.30	FEB 09, 1987	25.25	MAR 23, 1987	14.76	FEB 17, 1988	25.01
SEPT 30	10.16	10	25.25	SEPT 29	15.29	18	25.00
NOV 02	13.54	11	25.24	DEC 09	22.45	19	25.06
DEC 21	17.23	12	25.08	JAN 08, 1988	24.51	20	25.05
JAN 20, 1984	16.86	13	25.00	FEB 08	25.24	21	24.99
FEB 27	15.03	14	25.00	09	25.25	24	17.81
MAR 28	1.80	15	24.93	10	25.25	MAR 24	17.81
APR 26	+5.75	16	24.95	11	25.24	31	15.27
MAY 25	+0.82	17	25.01	12	25.08	APR 05	14.18
JUNE 22	+0.08	18	25.00	13	25.00	11	12.82
DEC 09, 1986	22.45	19	25.06	14	25.00	26	11.61
JAN 08, 1987	24.51	20	25.05	15	24.93	MAY 04	11.44
FEB 08	25.24	FEB 21, 1987	24.99	16	24.95		

Cartier well (D- 2- 4) 4DCC- 1

Records available 1970 to current year (1988)

Date	Water level						
MAR 26, 1987	31.15	NOV 24, 1987	29.43	FEB 13, 1988	30.78	MAR 01, 1988	30.42
APR 02	30.24	JAN 12, 1988	31.06	14	30.80	16	30.32
09	28.96	FEB 08	31.05	15	30.74	24	29.83
16	29.10	09	30.97	16	30.71	31	29.58
24	29.30	10	30.90	17	31.22	APR 26	25.33
MAY 07	27.56	11	30.87	18	32.70	MAY 04	19.03
OCT 14	18.06	FEB 12, 1988	30.80	22	32.78		

Table 3.—Water levels in 3 observation wells and 18 monitoring wells—Continued

MONITORING WELLS

PS-MW-1s (D- 2- 4) 9BDD- 1

Date	Water level						
AUG 07, 1987	27.71	FEB 08, 1988	30.71	FEB 15, 1988	29.71	MAR 24, 1988	23.16
31	26.85	09	30.61	16	29.71	31	23.20
SEPT 25	28.87	10	30.50	17	29.67	APR 05	23.41
OCT 14	29.67	11	30.45	18	29.64	07	23.44
NOV 24	30.28	12	30.11	19	29.70	11	23.62
30	30.45	13	30.00	20	29.68	14	23.73
JAN 07, 1988	32.35	14	29.81	21	29.65	MAY 04	24.16
FEB 06	30.76						

PS-MW-1d (D- 2- 4) 9BDD- 2

Date	Water level						
AUG 07, 1987	34.98	DEC 01, 1987	37.54	JAN 07, 1988	38.68	FEB 03, 1988	37.91
08	34.55	02	37.58	08	38.70	10	37.52
31	33.25	03	37.68	09	38.76	11	37.43
SEPT 09	33.87	04	37.73	10	38.82	12	37.21
25	35.22	05	37.75	11	38.79	13	36.99
OCT 14	35.86	06	37.84	12	38.89	14	36.90
NOV 10	37.39	07	37.88	13	38.96	15	36.82
11	37.42	08	37.96	14	39.01	16	36.80
12	37.47	09	37.98	15	38.98	17	36.80
13	37.51	10	37.99	16	39.05	18	36.75
14	37.53	11	37.72	17	39.09	19	36.82
15	37.58	12	37.59	18	39.10	20	36.84
16	37.57	13	37.55	19	39.17	21	36.66
17	37.58	14	37.59	20	39.19	22	36.54
18	37.71	15	37.52	21	39.20	23	36.34
19	37.65	26	37.13	22	39.18	24	36.00
20	37.46	27	37.44	23	39.12	25	35.82
21	37.40	28	37.69	24	39.12	MAR 01	33.25
22	37.38	29	37.87	25	39.06	16	29.22
23	37.36	30	37.95	26	39.00	24	28.76
24	37.34	31	38.16	27	38.92	31	28.45
25	37.32	JAN 01, 1988	38.29	28	38.79	APR 05	28.66
26	37.38	02	38.36	29	38.52	07	28.65
27	37.42	03	38.45	30	38.25	11	29.03
28	37.42	04	38.52	31	38.03	14	29.16
29	37.45	05	38.56	FEB 01	37.93	MAY 04	30.12
30	37.53	JAN 06, 1988	38.60	02	37.89		

PS-MW-2 (D- 2- 4) 9AAC- 2

Date	Water level						
AUG 07, 1987	30.39	FEB 06, 1988	35.09	FEB 14, 1988	34.66	FEB 21, 1988	34.83
SEPT 01	29.97	08	35.08	15	34.65	24	34.52
OCT 14	31.65	09	35.06	16	34.65	MAR 05	29.49
NOV 24	33.34	10	35.05	17	34.72	11	29.24
30	33.72	11	34.97	18	34.75	13	29.13
DEC 09	34.15	12	34.81	19	34.79	26	28.61
JAN 08, 1988	35.15	13	34.76	20	34.83	31	29.73

Table 3.—Water levels in 3 observation wells and 18 monitoring wells—Continued

PS-MW-3 (D- 2- 4) 9AAB- 1

Date	Water level						
AUG 07, 1987	22.34	FEB 06, 1988	25.53	FEB 14, 1988	25.43	FEB 20, 1988	25.45
SEPT 03	22.45	08	25.53	15	25.40	21	25.46
OCT 14	23.35	09	25.54	16	25.39	24	25.40
NOV 24	24.13	10	25.54	17	25.38	MAR 31	22.68
DEC 01	24.40	11	25.52	18	25.38	APR 12	22.49
JAN 12, 1988	25.47	12	25.49	19	25.41	MAY 04	21.87

PS-MW-4 (D- 2-4) 9ADC- 1

Date	Water level						
AUG 07, 1987	28.64	FEB 10, 1988	33.24	FEB 17, 1988	33.63	MAR 24, 1988	22.09
SEPT 01	28.59	11	33.18	18	33.72	29	21.22
OCT 14	31.69	12	32.97	19	33.85	31	21.32
NOV 24	32.30	13	32.85	20	33.94	APR 05	22.10
DEC 01	32.84	14	33.25	21	33.94	11	22.40
JAN 07, 1988	33.14	15	33.48	24	33.30	12	22.49
FEB 08	33.26	16	33.48	MAR 16	22.04	MAY 03	24.58
09	33.27						

PS-MW-5 (D- 2- 4)108CB- 1

Date	Water level						
AUG 07, 1987	15.96	FEB 09, 1988	22.22	FEB 16, 1988	22.25	MAR 24, 1988	15.45
SEPT 01	16.38	10	22.24	17	22.25	31	14.25
OCT 14	19.70	11	22.25	18	22.20	APR 05	14.15
NOV 24	19.29	12	22.25	19	22.23	11	13.81
DEC 01	19.93	13	22.28	20	22.31	12	13.79
JAN 07, 1988	21.47	14	22.25	25	22.14	MAY 04	13.72
FEB 06	22.18	FEB 15, 1988	22.25	MAR 16	16.59		

PS-MW-5d (D- 2- 4)108CB- 2

Date	Water level						
FEB 25, 1988	33.02	MAR 24, 1988	29.71	APR 05, 1988	28.65	APR 12, 1988	28.34
MAR 16	30.56	31	28.97	11	28.40	MAY 05	28.09

Table 3.—Water levels in 3 observation wells and 18 monitoring wells—Continued

PS-MW-6 (D- 2- 4)10BBC- 1

Date	Water level						
AUG 07, 1987	13.31	FEB 08, 1988	16.45	FEB 14, 1988	16.47	FEB 20, 1988	16.45
SEPT 02	13.44	09	16.45	15	16.47	21	16.45
OCT 14	14.71	10	16.46	16	16.45	24	16.40
NOV 24	15.09	11	16.46	17	16.45	MAR 31	13.78
DEC 01	15.26	12	16.47	18	16.45	APR 12	12.96
JAN 08, 1988	16.08	13	16.48	19	16.45	MAY 04	12.31

PS-MW-7 (D- 2- 4)10BBA- 1

Date	Water level						
AUG 07, 1987	10.69	FEB 10, 1988	11.20	FEB 17, 1988	11.19	MAR 24, 1988	11.01
SEPT 02	10.77	11	11.19	18	11.20	29	10.94
OCT 14	10.89	12	11.18	19	11.18	31	10.93
NOV 24	10.93	13	11.19	20	11.19	APR 05	10.89
DEC 01	10.97	14	11.17	21	11.18	11	10.88
JAN 07, 1988	11.12	15	11.19	25	11.19	12	10.88
FEB 08	11.20	16	11.19	MAR 16	11.07	MAY 03	10.82
09	11.20						

PS-MW-7d (D- 2- 4)10BBA- 2

Date	Water level						
FEB 16, 1988	15.63	FEB 20, 1988	15.75	MAR 24, 1988	14.68	APR 11, 1988	14.28
17	15.63	21	15.72	29	14.50	12	14.25
18	15.66	25	15.54	31	14.67	MAY 05	13.67
19	15.73	MAR 16	14.99	APR 05	14.42		

PS-MW-8 (D- 2- 4) 9AAC- 3

Date	Water level						
AUG 07, 1987	25.32	FEB 09, 1988	30.02	FEB 15, 1988	29.93	FEB 21, 1988	29.93
SEPT 01	25.31	10	30.00	16	29.92	24	29.93
OCT 14	27.45	11	29.98	17	29.91	MAR 31	22.95
NOV 24	28.33	12	29.97	18	29.91	APR 12	22.14
DEC 01	28.63	13	29.97	19	29.91	MAY 03	22.49
JAN 08, 1988	29.90	FEB 14, 1988	29.93	20	29.92		

Table 3.—Water levels in 3 observation wells and 18 monitoring wells—Continued

PS-MW-9		(D- 2- 4)10BAB- 1					
Date	Water level	Date	Water level	Date	Water level	Date	Water level
AUG 07, 1987	6.33	FEB 09, 1988	6.98	FEB 16, 1988	6.75	FEB 25, 1988	6.22
SEPT 02	6.19	10	6.93	17	6.82	MAR 31	5.71
OCT 14	5.50	11	6.80	18	6.93	APR 05	5.88
NOV 24	6.51	12	6.74	19	7.03	13	5.67
DEC 02	6.86	13	6.65	20	7.03	15	5.58
JAN 08, 1988	7.29	14	6.79	21	6.78	MAY 04	5.20
FEB 08	6.95	15	6.68				
PS-MW-10		(D- 2- 4) 3DCD- 1					
Date	Water level	Date	Water level	Date	Water level	Date	Water level
AUG 07, 1987	1.71	DEC 02, 1987	1.50	FEB 26, 1988	1.15	APR 14, 1988	1.00
SEPT 03	1.81	JAN 08, 1988	1.65	APR 12	1.01	MAY 04	0.31
NOV 24	1.35						
PS-MW-11		(D- 2- 4) 3CCD- 1					
Date	Water level	Date	Water level	Date	Water level	Date	Water level
SEPT 03, 1987	2.12	FEB 08, 1988	2.53	FEB 15, 1988	2.42	FEB 21, 1988	2.50
OCT 14	2.18	09	2.53	16	2.42	26	2.44
NOV 24	2.44	10	2.52	17	2.45	APR 05	1.79
DEC 02	2.53	11	2.50	18	2.44	12	1.72
JAN 12, 1988	2.70	12	2.47	19	2.53	14	1.72
FEB 06	2.53	14	2.47	20	2.55	MAY 03	1.50
PS-MW-11d		(D- 2- 4) 3CDC- 1					
Date	Water level	Date	Water level	Date	Water level	Date	Water level
FEB 09, 1988	9.59	FEB 15, 1988	9.52	FEB 19, 1988	9.77	APR 05	9.08
10	9.57	16	9.50	FEB 20, 1988	9.75	12	8.99
11	9.53	17	9.54	21	9.70	14	8.97
12, 1988	9.49	18	9.64	26	9.46	MAY 03	8.32
14	9.52						
PS-MW-12		(D- 2- 4) 9ACC- 1					
Date	Water level	Date	Water level	Date	Water level	Date	Water level
AUG 31, 1987	38.95	FEB 09, 1988	42.41	FEB 16, 1988	41.67	MAR 16, 1988	35.58
OCT 14	41.11	10	42.32	17	41.62	24	35.23
NOV 24	42.27	11	42.20	18	41.57	31	34.70
30	42.52	12	41.90	19	41.67	APR 05	34.88
JAN 07, 1988	43.80	13	41.80	20	41.66	11	35.15
FEB 06	42.50	14	41.80	21	41.56	14	35.28
08	42.45	15	41.71	23	41.40	MAY 03	36.17

Table 3.—Water levels in 3 observation wells and 18 monitoring wells—Continued

PS-MW-13 (D- 2- 4) 4DCB-1

Date	Water level						
FEB 08, 1988	8.33	FEB 25, 1988	8.62	APR 07, 1988	7.41	APR 24, 1988	7.09
09	8.12	26	8.39	08	7.45	25	7.53
10	7.91	27	8.19	09	7.45	26	7.77
11	7.87	28	8.04	10	7.43	27	7.86
12	7.81	29	7.90	11	7.40	28	8.18
13	7.74	MAR 01	7.82	12	7.39	29	8.40
14	7.77	16	7.72	13	7.37	30	8.32
15	7.70	25	7.53	14	7.39	MAY 01	8.30
16	7.70	29	7.42	15	7.44	02	8.22
17	8.80	30	7.57	16	7.36	03	8.63
18	10.74	31	7.77	17	7.38	04	8.78
19	12.36	APR 01	7.59	18	7.37	05	8.74
20	11.51	02	7.51	19	7.21	06	8.78
21	10.43	03	7.47	20	7.13	07	9.16
22	9.77	04	7.48	21	7.06	08	9.10
23	9.28	05	7.51	22	7.05	09	9.13
24	8.92	06	7.44	23	7.09	JUNE 06	11.98

PS-MW-14 (D- 2- 4) 4DCC-2

Date	Water level						
FEB 09, 1988	27.69	MAR 10, 1988	26.83	APR 09, 1988	25.73	MAY 08, 1988	19.84
10	27.65	11	26.84	10	25.67	09	19.84
11	27.64	12	26.87	11	25.62	10	20.01
12	27.59	13	26.90	12	25.58	11	20.55
13	27.57	14	26.90	13	25.53	12	19.92
14	27.58	15	26.89	14	25.50	13	18.97
15	27.55	16	27.07	15	25.63	14	17.78
16	27.56	17	26.99	16	25.39	15	17.52
17	27.90	18	26.92	17	25.35	16	18.14
18	28.55	19	26.83	18	24.89	17	18.16
19	28.97	20	26.79	19	22.39	18	17.70
20	28.97	21	26.76	20	20.97	19	17.81
21	28.78	22	26.70	21	19.13	20	18.12
22	28.59	23	26.64	22	19.12	21	17.80
23	28.45	24	26.58	23	19.60	22	18.15
24	28.28	25	26.71	24	20.03	23	18.29
25	28.13	26	26.43	25	20.23	24	17.67
26	27.98	27	26.31	26	20.47	25	17.90
27	27.84	28	26.21	27	20.44	26	18.28
28	27.56	29	26.10	28	19.96	27	18.68
29	27.29	30	26.14	29	19.43	28	19.48
MAR 01	27.24	31	26.17	30	19.02	29	19.36
02	27.11	APR 01	26.09	MAY 01	18.70	30	18.53
03	27.03	02	26.04	02	18.62	31	18.62
04	26.93	03	25.98	03	18.33	JUNE 01	18.26
05	26.85	04	25.96	04	18.99	02	18.23
06	26.84	05	25.93	05	19.21	03	18.50
07	26.86	06	25.85	06	19.89	04	18.75
08	26.88	07	25.78	07	20.15	05	19.00
09	26.84	08	25.77				

Table 4.—Estimated values of hydraulic conductivity (in feet per day)

Location	Hydraulic Conductivity	Method
PS-MW-1s	1	Bouwer and Rice
PS-MW-1d	<sup>1</sup> 1	Cooper, Bredehoeft, and Papadopoulos
PS-MW-2	7	Bouwer and Rice
PS-MW-3	9	Bouwer and Rice
PS-MW-4	3	Bouwer and Rice
PS-MW-5	2	Bouwer and Rice
PS-MW-5d	<sup>1</sup> 1	Cooper, Bredehoeft, and Papadopoulos
PS-MW-6	<sup>1</sup> 10	Bouwer and Rice
PS-MW-7	14	Bouwer and Rice
PS-MW-7d	2	Cooper, Bredehoeft, and Papadopoulos
PS-MW-8	<sup>1</sup> 1	Bouwer and Rice
PS-MW-9	<sup>1</sup> 10	Bouwer and Rice
PS-MW-10	4	Bouwer and Rice
PS-MW-11	6	Bouwer and Rice
PS-MW-11d	<sup>1</sup> 10	Bouwer and Rice
PS-MW-12	2	Bouwer and Rice

<sup>1</sup>Values rounded to nearest order of magnitude.

**Table 5.—Field parameters at surface-water sites**  
 [°C, degrees Celsius;  $\mu\text{S}/\text{cm}$ , microsiemens per centimeter at 25° Celsius; ft, feet;  
 s, second; mg/L, milligrams per liter]

Location	Date	Temper- ature, field (° C)	Specific conductance, field ( $\mu\text{S}/\text{cm}$ )	Instan- taneous discharge (ft <sup>3</sup> /s)	pH, field (units)	Alkalinity, field (mg/L as $\text{CaCO}_3$ )	Bicarbonate (mg/L)	Carbonate (mg/L)
Silver Creek at Bonanza Drive	04-29-87	18.5	990	0.76	8.6	102	120	12
	07-09-87	19.0	925	0.04	8.6	84	104	0
	04-13-88	15.5	1,190	1.99	8.5	107	131	0
Silver Creek at Wyatt Earp Drive	04-29-87	18.0	1,080	0.65	8.6	100	120	8
	07-09-87	19.5	1,570	0.002	8.0	123	150	0
	04-13-88	15.5	1,200	1.45	8.5	109	153	0
Silver Creek below Prospector Square	04-29-87	11.0	990	2.18	7.5	151	180	0
	07-09-87	13.5	1,450	0.24	7.4	105	128	0
	04-13-88	13.0	1,010	4.31	7.8	152	185	0
Pace-Homer Ditch at Park Meadows Collection box	04-29-87	15.5	720	0.08	8.0	174	210	0
	07-09-87	19.5	825	2.03	8.2	116	142	0
	04-13-88	10.0	695	0.893	8.0	186	227	0
Pace-Homer Ditch below Prospector Square	04-29-87	13.0	830	1.33	7.9	184	220	0
	07-09-87	18.0	870	2.50	8.2	134	164	0
	04-13-88	9.0	775	2.44	7.6	185	225	0

<sup>1</sup>Values determined by State lab.

collected from surface water sites  
 EPA, U.S. Environmental Protection Agency;  
 dashes indicate no data; <, less than}

Barium, dis- solved ( $\mu\text{g/L}$ as Ba)	Beryl- ium, dis- solved ( $\mu\text{g/L}$ as Be)	Cad- mium, dis- solved ( $\mu\text{g/L}$ as Cd)	Chro- mium, dis- solved ( $\mu\text{g/L}$ as Cr)	Cobalt, dis- solved ( $\mu\text{g/L}$ as Co)	Copper, dis- solved ( $\mu\text{g/L}$ as Cu)	Iron, dis- solved ( $\mu\text{g/L}$ as Fe)	Lead, dis- solved ( $\mu\text{g/L}$ as Pb)	Manga- nese, dis- solved ( $\mu\text{g/L}$ as Mn)	Mercury, dis- solved ( $\mu\text{g/L}$ as Hg)	Nickel, dis- solved ( $\mu\text{g/L}$ as Ni)	Silver, dis- solved ( $\mu\text{g/L}$ as Ag)	Zinc, dis- solved ( $\mu\text{g/L}$ as Zn)	
83	<0.5	1	<10	<3	10	8	<10	130	<0.1	<10	<10	<1	68
74	<1	1	<5	<20	<20	40	10	120	<0.25	<10	<24	--	59
<70	<3	<4	<10	<20	30	<60	7	122	<0.4	<24	--	--	62
61	<0.5	1	<10	<3	10	15	<10	12	<0.1	<10	<1	<1	28
51	--	1	<5	--	--	<20	10	11	--	--	--	<10	30
49	<1	<4	<4	<9	6.1	29	<5	18	<0.2	<8	<4	<4	38
94	<0.5	4	<5	<3	10	6	<10	290	--	<10	<10	<1	140
81	<1	<1	<5	<20	<20	20	<5	270	<0.2	<10	<2	<2	150
84	<0.5	2	<10	<3	<10	4	<10	280	<0.1	--	<10	<1	80
75	<1	2	<5	<20	<20	<20	10	260	0.2	<10	<2	<2	70
80	<3	<4	<10	<30	23	<60	9	259	<0.2	<24	--	--	68
73	<0.5	13	<10	<3	<10	4	<10	2,910	0.1	--	<1	<1	3,400
62	--	17	<5	--	--	<20	<5	2,900	--	--	<10	<10	3,300
60	<1	17	<4	<9	10	27	<5	2,970	<0.2	8.5	<4	<4	3,500
88	<0.5	2	<5	<3	<10	5	<10	240	--	<10	<10	<1	160
74	<1	<1	<5	<20	<20	20	<5	220	<0.2	<10	<2	<2	170
41	<1	4	<5	<20	<20	<20	10	360	0.25	<10	<2	<10	590
<70	<3	<4	<10	<30	16	<60	8	353	<0.2	<24	<10	<10	559
49	--	7	<5	--	--	81	--	970	--	--	<8	<10	2,300
46	<1	6	<4	<4	<6	80	6.2	980	<0.2	<8	<4	<4	2,380
49	<0.5	2	<5	<3	<10	15	<10	180	--	<10	<10	1	280
39	<1	<1	<5	<20	<20	20	<5	170	<0.2	<10	<2	<2	270
50	<1	<1	<5	<20	<20	320	<5	170	0.2	<10	<2	<2	33
<70	<3	<4	<10	<30	<11	<60	<5	158	<0.2	<24	--	--	32
22	--	<1	<5	--	9	--	<20	<5	57	--	<8	<10	<15
22	<1	<4	<4	--	28	<24	<5	60	<0.2	<8	<4	<4	16
64	<0.5	2	<5	<3	<10	22	<10	310	--	<10	<10	<1	4
52	<1	<1	<5	<20	<20	21	<5	290	<0.2	<10	<2	<2	29
23	<1	<1	<5	<20	<20	580	5	75	0.25	<10	<24	<2	52
<70	<3	<4	<10	<30	13	110	27	72	<0.2	<24	<10	<10	63
30	--	<1	<5	--	--	20	<5	11	--	<8	<10	<4	26
28	<1	<4	<4	<9	11	<24	14	23	<0.2	<8	<4	<4	23
44	<0.5	<1	<5	<3	<10	16	<10	110	--	<10	<10	<1	47
36	<1	<1	<5	<20	<20	20	<5	110	<0.2	<10	<2	<2	62

Table 6.—Chemical analyses of filtered water  
 [USGS, U.S. Geological Survey; State, Utah Department of Health;  
 mg/L, milligrams per liter;  $\mu\text{g}/\text{L}$ , micrograms per liter;

Location	Date of sample	Report-ing-agency	Cal-cium, dis-solved (mg/L as Ca)	Magne-sium, dis-solved (mg/L as Mg)	Sodium, dis-solved (mg/L as Na)	Potas-sium, dis-solved (mg/L as K)	Chlo-ride, dis-solved (mg/L as Cl)	Sul-fate, dis-solved (mg/L as $\text{SO}_4^{2-}$ )	Alum-inum, dis-solved ( $\mu\text{g}/\text{L}$ as Al)	Arsenic, dis-solved ( $\mu\text{g}/\text{L}$ as As)
Silver Creek at Bonanza Drive	04-29-87	USGS State EPA	79 76 78.4	16 15 5.5	100 96 95.8	2.9 3 8	200 173 --	120 110 --	-- <200 <140	5 5.5 <10
	07-09-87	USGS State EPA	78 -- 79.4	17 -- 17.3	71 -- 76.5	2.9 -- 3.2	150 -- --	110 -- --	-- -- 32	6 7 <10
	04-13-88	USGS State EPA	82 --	17 --	130 --	3.1 --	260 267.4	92 82	-- --	3 2.5
Silver Creek at Wyatt Earp Drive	04-29-87	USGS State EPA	87 83 83	17 17 17.1	110 100 106	2.9 3 2.7	220 174 --	150 120 --	-- <200 <140	5 4.5 <10
	07-09-87	USGS State EPA	230 -- 238	62 -- 63.1	39 -- 40.6	3.9 -- 4.2	55 -- --	650 -- --	-- -- 17	2 3.2 <10
	04-13-88	USGS State EPA	83 --	17 --	130 --	3.3 --	260 259.5	100 89	-- --	3 1.5
Silver Creek below Prospector Square	04-29-87	USGS State EPA	120 123	27 27.2	44 46.7	2 2.4	98 --	210 --	<200 <140	5.5 <10
	07-09-87	USGS State EPA	-- 218	-- 34.4	-- 48	-- 3.8	-- --	-- --	-- 26	9.5 <10
	04-13-88	USGS State EPA	110 --	27 --	64 --	2.9 --	140 147.5	180 180	-- --	6 5.5
Pace-Homer Ditch at Park Meadows Collection box	04-29-87	USGS State EPA	91 94.2	31 29.8	17 17.3	2 1.8	27 --	180 --	<200 <140	12.5 <10
	07-09-87	USGS State EPA	-- 120	-- 36.3	-- 8.8	-- 1.8	-- --	-- --	-- 16	18.5 17
	04-13-88	USGS State EPA	89 --	29 --	20 --	2.6 --	28 29.9	150 140	-- --	8 5.5
Pace-Homer Ditch below Prospector Square	04-29-87	USGS State EPA	100 107	31 30.5	22 23.3	2 1.7	15.5 --	170 --	<200 <140	5.5 <10
	07-09-87	USGS State EPA	-- 120	-- 33.8	-- 16.8	-- 1.9	-- --	-- --	-- 20	12.5 11
	04-13-88	USGS State EPA	110 --	30 --	23 --	2.1 --	47 48	180 170	-- --	5 2.5

**Table 7.-Chemical analyses from unfiltered  
[USGS, U.S. Geological Survey; State, Utah Department of Health;  
µg/L, micrograms per liter]**

LOCATION	DATE OF SAMPLE	REPORTING AGENCY	CALCIUM, TOTAL (mg/L AS Ca)	MAGNESIUM, TOTAL (mg/L AS Mg)	SODIUM, TOTAL (mg/L AS Na)	POTASSIUM, TOTAL (mg/L AS K)	ALUMINUM, TOTAL (µg/L AS Al)	ARSENIC, TOTAL (µg/L AS As)	BARIUM, TOTAL (µg/L AS Ba)
Silver Creek at Bonanza Drive	04-29-87	USGS State EPA	72 77 76.9	17 16 15.7	90 97 97	2.8 3 3.2	— 580 1,360	17 18 27	100 91 80
		USGS State EPA	71 — 78.9	16 — 17.2	62 — 76.4	2.7 — 3	— — 60	6 7 <10	<100 51 51
		USGS State EPA	79 97.3	16 22.4	130 54.6	3 1.9	<400 <100	2 5.2	73 34
	07-09-87	USGS State EPA	74 78 78.2	17 16 15.7	91 — 563	2.7 — 3.3	— 500 1,370	18 14 17	100 80 <70
		USGS State EPA	170 — 238	50 — 63.1	29 — 40.6	3.6 — 42	— 3.5 17	2 62 <10	<100 60
		USGS State EPA	81 69.8	17 14.2	130 110	3 1.9	450 <100	5.5 28	84 66
	04-13-88	USGS State EPA	120 120	27 26.6	45 47	3 2.4	<200 420	10 12	44 <70
		USGS State EPA	— 225	— 34.7	— 49.4	— 4	— 198	16 12	47 46
		USGS State EPA	110 71.1	26 14.4	66 112	3 1.6	<400 <100	3.5 <2	36 --
Pace-Homer Ditch at Park Meadows Collection box	04-29-87	USGS State EPA	91 95.7	31 31.1	17 17.5	2 1.9	<200 <140	10.5 10	51 <70
		USGS State EPA	— 118	— 35.4	— 9.4	— 1.9	— 71	19 18	23 11
		USGS State EPA	86 77.2	27 24.9	20 17.5	3 1.5	<400 <100	5.5 5.4	55 46
	07-09-87	USGS State EPA	100 105	30 29.8	22 22.8	2 1.7	<200 <140	7.5 <10	25 <70
		USGS State EPA	— 120	— 33.2	— 16.1	— 1.8	— 32	13 12	31 30
		USGS State EPA	100 91.5	28 25.6	22 19.4	2 1.2	<400 <100	3.5 5.2	39 31

## water collected at surface-water sites

EPA, U.S. Environmental Protection Agency; mg/L, milligrams per liter;  
dashes indicate no data; <, less than

Beryl- ium, total ( $\mu\text{g/L}$ as Be)	Cad- mium, total ( $\mu\text{g/L}$ as Ca)	Chro- mium, total ( $\mu\text{g/L}$ as Cr)	Cobalt, total ( $\mu\text{g/L}$ as Co)	Copper, total ( $\mu\text{g/L}$ as Cu)	Cyan- ide, total ( $\mu\text{g/L}$ as Cn)	Iron, total ( $\mu\text{g/L}$ as Fe)	Lead, total ( $\mu\text{g/L}$ as Pb)	Manga- nese, total ( $\mu\text{g/L}$ as Mn)	Mercury, total ( $\mu\text{g/L}$ as Hg)	Nickel, total ( $\mu\text{g/L}$ as Ni)	Silver, total ( $\mu\text{g/L}$ as Ag)	Zinc, total ( $\mu\text{g/L}$ as Zn)
--	8	<10	--	44	<10	1,900	700	290	0.3	--	1	960
<1	5	<4	<10	38.0	<20	1,600	700	290	0.75	<10	<2	870
<3	4	<4	<30	54	<10	2,350	580	309	<0.2	<24	<10	525
--	<1	<1	<10	--	8	<10	150	20	0.1	--	2	50
<1	<1	<4	<5	--	<20	110	10	13	<0.2	--	<0.2	57
<1	<4	<4	<9	11	<10	192	42	28	<0.2	<8	<4	77
--	<1	<1	<6	<20	<20	<20	<5	<5	<0.2	<10	<2	65
<2	<1.1	<4	<6	22	19	111	14	165	<0.2	<11	5.5	260
--	7	<10	--	38	<10	1,400	440	350	0.3	--	1	620
<1	4	<5	<20	31	<20	1,100	430	350	0.55	<10	<2	560
<3	4	<10	<30	40	<10	1,860	330	309	<0.2	<24	<10	525
--	<3	46	--	5	<10	90	18	2,400	<0.1	--	2	3,100
<1	16	<5	<9	<20	--	72	<5	2,900	<0.2	--	<0.2	3,300
<1	17	<4	<9	10	--	27	<5	2,970	<0.2	8.5	<4	3,500
<1	4	<4	<20	<20	<20	770	<5	310	<0.2	<10	<5	440
<2	1.1	<4	<6	21	<10	<100	4.2	207	<0.2	<11	<5	151
--	6	<5	<20	<20	<20	580	165	410	0.65	<10	<2	780
<3	4	<10	<30	26	--	810	166	382	<0.2	<24	<1	755
--	7	<5	--	220	00	79	105	1,000	<0.2	--	<0.2	2,500
<1	7.1	<4	<9	16	<10	759	161	1,050	0.3	8.6	<4	2,610
--	1	<1.1	<4	<6	<20	23	<20	<20	<5	<11	10	100
<2	<1.1	<4	<6	<20	<10	<100	3.5	260	<0.2	<11	<5	136
--	<1	<4	<10	<30	<20	<10	<5	170	0.25	<10	<2	31
<3	<4	<10	<30	<11	<10	120	<5	129	<0.2	24	<2	29
--	<1	<4	<5	--	56	--	<5	83	<0.2	--	<4	100
<1	<1	<4	<9	56	<10	90	<5	86	<0.2	<8	<4	23
--	<2	<1.1	<4	<6	<20	14	<20	121	<2	<11	<5	<20
<2	<1.1	<4	<6	<20	<10	83	17	310	<0.2	10	<5	14
--	<1	<4	<10	<30	<20	<10	61	30	82	0.75	<10	<2
<3	<4	<4	<9	20	<10	<60	24	63	<0.2	24	119	62
--	<1	<4	<5	--	<20	16	--	57	<0.2	--	<4	240
<1	<4	<4	<9	16	<10	65	<5	33	<0.2	<8	<4	28
--	<2	<1.1	<4	<6	<20	10	<20	152	<0.2	<10	<5	64
<2	<1.1	<4	<6	<20	<10	57	<5	120	<0.2	<11	<5	50

**Table 8.—Chemical analyses of total recoverable metals from stream sediment**  
 [Constituents in parts per million; USGS, U.S. Geological Survey; State, Utah Department of Health;  
 EPA, U.S. Environmental Protection Agency]

Surface-water sampling April 29, 1987

Silver Creek at Bonanza Drive			Silver Creek at Wyatt Earp Drive			Silver Creek below Prospector Square		Pace Homer Ditch below Prospector Square	
USGS	State	EPA	USGS	State	EPA	State	EPA	State	EPA
Arsenic	190	180	2,173	220	--	229	300	256	190
Barium	470	180	263	510	--	200	37	213	37
Cadmium	27	29	43	38	--	33	72	45	32
Chromium	100	49	186	80	--	52	31	50	49
Copper	330	240	280	390	--	191	360	343	360
Iron	30,000	22,000	54,500	37,000	--	30,600	30,000	36,400	25,000
Lead	5,200	4,500	5,900	6,000	--	3,910	4,300	5,960	3,600
Manganese	1,700	1,400	5,020	1,600	--	1,430	1,300	1,570	1,500
Mercury	<4.	2.5	16	<4.	--	24	5.5	8.5	7
Silver	38	21	18	42	--	28	31	31	26
Zinc	5,500	4,000	7,390	7,800	--	6,130	9,300	8,320	4,500
									4,710

Surface-water sampling on July 9, 1987

Silver Creek at Bonanza Drive			Silver Creek at Wyatt Earp Drive			Silver Creek below Prospector Square		Pace-Homer Ditch below Prospector Square	
USGS	State	EPA	USGS	State	EPA	State	EPA	State	EPA
Arsenic	140	58	514	57	46	25	58	385	220
Barium	430	150	682	520	170	93	6.7	96	150
Cadmium	32	29	123	23	24	14	83	63	43
Chromium	100	41	115	81	44	15	19	14	38
Copper	280	170	1,200	120	69	58	580	400	430
Iron	35,000	23,000	86,300	25,000	24,000	13,000	32,000	24,000	22,000
Lead	4,900	3,200	19,300	1,700	960	670	7,700	5,000	4,600
Manganese	1,500	1,300	4,090	3,700	2,200	2,050	1,700	1,650	1,100
Mercury	6.6	3.6	14	4.4	2.2	1.5	6.5	7.2	16
Silver	26	15	110	10	5.3	5.9	51	35	36
Zinc	6,800	4,500	22,900	4,100	3,300	3,130	15,000	12,800	7,400
									2,330

Surface-water sampling on April 13, 1988

Silver Creek at Bonanza Drive			Silver Creek at Wyatt Earp Drive			Silver Creek below Prospector Square		Pace-Homer Ditch below Prospector Square	
State	EPA		State	EPA		State	EPA	State	EPA
Arsenic	93	165		100	22.9		370	78.4	200
Barium	200	73.1		140	109		6	164	170
Cadmium	15	96.5		14	3.5		140	23.6	31
Chromium	75.5	14.3		43	24.6		30	31.5	72
Copper	93	317		63	36.4		1,400	173	440
Iron	2,000	23,200		29,000	25,700		30,000	21,000	3,500
Lead	1,300	5,290		380	164		12,000	2,960	3,100
Manganese	1,800	1,910		410	294		1,900	1,450	1,300
Mercury	1.2	3.6		0.4	0.3		3.4	1.8	6.7
Silver	6.8	31.6		3	2.7		86	15.4	20
Zinc	2,100	19,000		720	372		30,000	3,670	4,700
									4,890

Table 9.—Chemical analyses of  
[°C, degrees Celsius;  $\mu\text{S}/\text{cm}$ , microsiemens per centimeter at 25 °Celsius;  
EPA, U.S. Environmental Protection Agency; mg/L, milligrams per liter;

Location	Date of sample	Temper-ature, field (°C)	Spe-cific con-duct-ance, field ( $\mu\text{S}/\text{cm}$ )	pH, field (units)	Report-ing-agency	Alka-linity, lab (mg/L as $\text{CaCO}_3$ )	Bi-carbo-nate (mg/L)	Carbo-nate (mg/L)	Cal-cium, dis-solved (mg/L as Ca)	Magne-sium, dis-solved (mg/L as Mg)	Sodium, dis-solved (mg/L as Na)	Potas-sium, dis-solved (mg/L as K)	Chlo-ride, dis-solved (mg/L as Cl)	Sul-fate, dis-solved (mg/L as $\text{SO}_4$ )
PS-MW-1s (D-2-4)9bdd-1	08-31-87	13.5	3,830	6.8	USGS State EPA	140 -- --	-- -- --	-- -- --	320 340 354	61 60 61.7	270 260 277	3.3 3 4.03	910 925 --	260 250 --
	11-30-87	10.5	3,530	6.8	USGS State EPA	137 --	168 --	0 --	340 359	63 62.1	280 310	3 3.52	885 --	270 --
	04-11-88	11.0	3,380	6.1	USGS State EPA	138 135	169 --	0 --	320 294	55 51.8	270 --	3 3.5	889.9 860	240 260
PS-MW-1d (D-2-4)9bdd-2	08-31-87	13.0	1,840	6.8	USGS State EPA	90 -- --	-- -- --	-- -- --	220 230 220	43 44 41.3	74 77 72.1	2.3 2 2.32	380 380 --	240 240 --
	11-30-87	10.0	2,060	6.7	USGS State EPA	114 --	140 --	0 --	260 249	52 49.3	88 91.1	2 2.39	450 --	270 --
	02-23-88	10.0	2,100	7.4	USGS State EPA	113 --	-- --	-- --	260 248	48 47.6	88 83.6	2 2.5	500 --	250 --
PS-MW-2 (D-2-4)9aac-2	04-11-88	12.0	2,160	6.6	USGS State EPA	115 113 102	-- 138 --	-- 0 --	250 260 230	51 49 44.5	88 87 80.2	2.3 2 1.6	500 534.9 437	260 240 238
	09-01-87	14.0	1,740	6.7	USGS State EPA	108 -- --	-- -- --	-- -- --	220 230 --	44 44 41.8	58 53 51.1	2.0 2 1.57	370 357 --	200 210 --
	11-30-87	10.0	1,770	6.5	USGS State EPA	121 --	148 --	0 --	230 255	46 50.5	54 61.5	2 2.04	362 --	210 --
PS-MW-3 (D-2-4)9aab-1	02-24-88	8.5	1,220	7.2	USGS State EPA	121 --	-- --	-- --	240 220	43 42.1	50 48	2 2.2	360 --	200 --
	04-11-88	12.5	1,710	6.2	USGS State EPA	122 121 112	-- 147 --	-- 0 --	220 220 210	43 42 40.3	50 49 48.6	1.9 2 1.4	340 364.9 332	230 210 226
	09-03-87	10.0	1,730	7.0	USGS State EPA	146 -- --	-- -- --	-- -- --	180 180 184	35 36 35.9	110 110 114	1.9 2 1.63	350 345 --	190 180 --
	12-01-87	10.0	1,630	6.7	USGS State EPA	154 --	188 --	0 --	170 186	34 36.9	110 134	2 1.94	300 --	200 --
	02-24-88	9.0	1,580	7.0	USGS State EPA	155 --	-- --	-- --	160 153	31 29.5	110 104	2 2.3	310 --	180 --
	04-12-88	13.5	1,580	6.7	USGS State EPA	151 150 142	-- 184 --	-- 0 --	170 170 157	34 32 31.3	110 110 --	1.9 2 1.6	330 349.9 292	170 180 --



Table 9.—Chemical analyses of

Location	Date of sample	Temperature, field (°C)	Specific conductance, field (µS/cm)	pH, field	Reporting agency	Alkalinity, lab (mg/L as CaCO <sub>3</sub> )	Bicarbonate (mg/L)	Carbonate (mg/L)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Potassium, dissolved (mg/L as K)	Chloride, dissolved (mg/L as Cl)	Sulfate, dissolved (mg/L as SO <sub>4</sub> )
PS-MW-4 (D-2-4)0adc-1	09-01-87	13.0	1,490	6.4	USGS State EPA	87 -- -- --	-- -- -- --	-- -- -- --	220 220 226 39.1	38 39 54.9 54.9	42 53 8.1	6.7 7	140 132 --	540 530 --
	12-01-87	11.0	1,540	6.9	USGS State EPA	104 --	128 --	0 --	240 262	39 47.8	51 62.6	6 6.93	130 --	540 --
	02-24-88	10.5	1,710	7.3	USGS State EPA	97 --	-- --	-- --	230 220	40 38.2	80 71.4	7 6.6	262 --	450 --
	04-12-88	12.0	1,380	6.2	USGS State EPA	60 60 55	-- 74 --	-- 0 --	200 190 177	34 33 30.7	47 52 50.9	7.2 7 5.3	150 153 145	490 470 --
PS-MW-5 (D-2-4)10bab-1	09-01-87	14.5	1,350	6.5	USGS State EPA	54 -- --	-- -- --	-- -- --	190 200 206	34 34 35.2	56 54 57.1	4.2 4 5.25	130 125 --	500 500 --
	12-01-87	11.0	1,300	6.7	USGS State EPA	80 80 --	-- 98 --	-- 0 --	190 190 189	33 34 34.8	49 48 55.2	3.3 3 3.39	110 105 --	460 470 --
	02-24-88	11.5	1,250	6.9	USGS State EPA	104 104 --	-- -- --	-- -- --	190 210 199	35 37 36.5	39 40 40.8	-- 2 2.3	88 90 --	490 500 --
	04-12-88	12.0	1,300	6.2	USGS State EPA	63 63 58	-- 77 --	-- 0 --	220 180 165	43 32 29.3	49 50 46	3.8 4 2.5	130 130 125	470 460 484
PS-MW-5d (D-2-4)10bcb-2	02-25-88	12.0	775	7.5	USGS State EPA	114 114 --	-- -- --	-- -- --	110 110 108	27 27 25.9	16 16 15	1.7 2 1.4	33 34.9 --	260 250 --
	04-12-88	12.0	775	7.1	USGS State EPA	115 115 108	-- 141 --	-- 0 --	110 110 99.8	27 26 24	16 15 14.2	1.2 1 0.7	33 31.9 36	260 240 258
PS-MW-6 (D-2-4)10bbc-1	09-02-87	16.0	1,520	6.5	USGS State EPA	55 -- --	-- -- --	-- -- --	230 240 247	33 33 34	44 42 44.6	4.4 5 5.48	130 132 --	550 550 --
	12-01-87	11.0	1,470	6.9	USGS State EPA	55 57 --	-- 70 --	-- 0 --	230 240 236	32 32 33.2	42 40 43.8	4.3 4 4.3	140 130 --	540 540 --
	02-24-88	11.0	1,380	6.5	USGS State EPA	55 56 --	-- -- --	-- -- --	210 220 198	29 29 27.3	38 38 33.8	4.3 4 --	130 127 --	490 500 --
	04-12-88	14.0	1,370	6.3	USGS State EPA	56 55 50	-- 67 --	-- 0 --	220 230 208	32 30 29.5	41 40 38.5	4.3 4 2.9	130 138 112	540 530 --

## water from wells and drains—Continued

Alum- inum, dis- solved ( $\mu\text{g/L}$ as Al)	Arsenic, dis- solved ( $\mu\text{g/L}$ as As)	Barium, dis- solved ( $\mu\text{g/L}$ as Ba)	Beryl- ium, dis- solved ( $\mu\text{g/L}$ as Be)	Cad- mium, dis- solved ( $\mu\text{g/L}$ as Cd)	Chro- mium, dis- solved ( $\mu\text{g/L}$ as Cr)	Cobalt, dis- solved ( $\mu\text{g/L}$ as Co)	Copper, dis- solved ( $\mu\text{g/L}$ as Cu)	Cyan- ide, Total ( $\mu\text{g/L}$ as Cn)	Iron, dis- solved ( $\mu\text{g/L}$ as Fe)	Lead, dis- solved ( $\mu\text{g/L}$ as Pb)	Manga- nese, dis- solved ( $\mu\text{g/L}$ as Mn)	Mercury, dis- solved ( $\mu\text{g/L}$ as Hg)	Nickel, dis- solved ( $\mu\text{g/L}$ as Ni)	Silver, dis- solved ( $\mu\text{g/L}$ as Ag)	Zinc, dis- solved ( $\mu\text{g/L}$ as Zn)
--	<1	38	<0.5	5	<5	<3	<10	--	23	<10	300	--	<10	<1	1,800
<400	<1.1	27	<1	6	<30	<9	<20	<20	290	<5	300	<0.2	--	<2	1,700
<100	<6	40	<4	6.4	<9	<7	<17	<10	<100	<2	317	<0.2	<6	<7	1,940
--	<1.1	40	2	3	<5	<20	<20	<20	120	5	1,800	<0.2	<10	<2	640
<400	<2	47	<2	3.2	<10	<25	<8	<10	145	3.1	2,250	<0.2	<22	<6	759
<200	1	43	<1	2	<5	<9	<20	<20	91	5	2,700	<0.2	10	<2	400
<100	<3	<45	4	<0.5	<5	<9	<26	<1	259	<2	2,750	<0.2	9.5	<8	361
--	<1	60	<0.5	9	<5	<3	<10	--	3	<10	46	--	<10	<1	2,300
<400	<1.1	22	<1	8	<5	<4	<20	<20	<20	<5	46	<0.2	<10	<2	2,400
<100	<2	20	<2	<5.5	<4	<6	<12	18	<100	<3	44	<0.2	<11	<5	2,290
--	<1	51	<0.5	6	<5	<3	<10	--	33	<10	120	--	10	<1	2,300
<400	1.2	38	<1	—	<30	<9	<20	<20	380	<5	120	<0.2	--	<2	2,100
<100	<6	42.5	<4	7.1	<9	<7	<17	<10	<100	<2	126	<0.2	12.4	<7	2,460
--	1	50	<0.5	3	<5	<3	<10	--	29	<10	260	--	<10	1	880
<400	<1.1	45	1	—	<5	<10	<20	<20	86	<5	260	<0.2	<10	<2	930
<90	<2	49	<2	3.1	<10	<25	<8	<10	32	2.7	276	<0.2	<22	<6	899
--	<1	38	<0.5	3	<5	<3	<10	--	150	<10	120	--	<10	<1	71
<200	<1	31	<1	<1	<5	<9	<20	<20	20	<5	100	<0.2	<10	<2	97
<100	<3	<45	<4	<0.5	<9	<9	<12	<1	<100	3	487	0.2	<7	<8	<20
--	<1	62	<0.5	2	<5	<3	<10	--	4	<10	2	--	<10	<1	—
<400	<1.1	32	<1	—	<5	<6	<20	<20	<20	<5	44	<0.2	<10	<2	1,900
<100	<2	29	<2	3.6	5.2	<6	12	16	121	<3	47	<0.2	13	<5	1,780
--	<1	89	<0.5	2	<5	<3	<10	--	14	<10	500	--	<10	<1	19
<460	<1	82	<1	<1	<5	<9	<20	<20	260	<5	470	<0.2	<10	<2	59
<100	<3	<45	<4	<0.5	<9	<9	<12	<1	<100	10	107	0.4	<7	<8	74
--	2	73	<0.5	<1	<5	<3	<10	--	3	<10	88	--	<10	<1	6
<400	<1.1	67	<1	<1	<1	<4	<20	<20	<20	<5	86	<0.2	<10	<2	<20
<100	<2	61	<2	<1.1	<4	<6	<14	<10	<100	<3	82	<0.2	<11	<5	8.8
--	<1	38	<0.5	6	<5	<3	<10	--	14	<10	440	--	<10	<1	1,100
<400	<1.1	25	<1	—	<30	<9	<20	<20	160	<5	440	<0.2	--	<2	1,100
136	<6	40	<4	5.9	<9	<7	<17	<10	136	<2	456	<0.2	<6	<7	1,210
--	1	27	<0.5	7	<5	<3	<10	--	51	<10	270	--	<10	<1	1,200
<400	<1.1	22	<1	—	<5	<10	<20	<20	<20	<5	280	<0.2	<10	<2	1,400
<90	<2	23	<2	5.8	<10	<25	<8	<10	89	2.0	287	<0.2	<22	<6	1,300
--	2	34	<0.5	7	<5	<3	<10	--	9	<10	82	--	<10	<1	1,100
<200	<1	26	<1	6	<5	<9	<20	<20	<20	<5	85	0.25	<10	<2	1,100
<100	<3	<45	<4	5.4	<9	<9	14	<1	<100	2.6	80	0.3	<7	<8	1,060
--	<1	31	<0.5	8	<5	<3	<10	--	6	<10	—	--	<10	<1	1,500
<400	<1.1	22	<1	8	<5	<6	<20	<20	<20	<5	57	<0.2	<10	<2	1,600
<100	<2	20	<2	5.5	5.1	<6	18	<10	<100	<3	63	<0.2	<11	<5	1,540

Table 9.--Chemical analyses of

Location	Date of sample	Temperature, field (°C)	Specific conductance, field (µS/cm)	pH, field	Report-ing-agency	Alka-linity, lab (mg/L as CaCO <sub>3</sub> )	Bi-carbo-nate (mg/L)	Carbo-nate (mg/L)	Cal-cium, dis-solved (mg/L as Ca)	Magne-sium, dis-solved (mg/L as Mg)	Sodium, dis-solved (mg/L as Na)	Potas-sium, dis-solved (mg/L as K)	Chlo-ride, dis-solved (mg/L as Cl)	Sul-fate dis-solved (mg/L as SO <sub>4</sub> )
PS-MW-7 (D-2-4)10bba-1	09-02-87	16.0	1,570	6.4	USGS State EPA	47 -- -- --	-- -- 72 --	-- 0 0 --	250 260 269 33.2	33 33 53.1 7.05	42 52 53.1 6	5.7 6 7.05 --	110 110 -- --	660 660 -- --
	12-01-87	10.0	1,530	6.4	USGS State EPA	49 59 --	-- 72 --	240 260 225	30 31 29.2	41 51 50.3	5.4 6 5.34	110 110 --	110 110 --	630 640 --
	02-25-88	6.5	1,310	6.2	USGS State EPA	50 56 --	-- -- --	220 240 220	29 29 27.4	42 51 46.6	2.5 5 5.1	120 120 --	120 120 --	580 590 --
	04-12-88	12.5	1,450	6.0	USGS State EPA	59 58 --	-- 71 --	230 230 216	30 28 27.2	42 49 47.2	5.5 5 3.5	120 120 112	120 120 --	610 580 --
PS-MW-7d (D-2-4)10bba-2	02-25-88	8.0	355	7.5	USGS State EPA	121 119 --	-- -- --	43 44 41.8	11 12 11	11 12 10.3	1.1 1 <0.5	12 12 --	45 45 --	45 45 --
	04-12-88	13.5	339	7.4	USGS State EPA	123 123 115	-- 150 --	-- 0 37.2	44 43 10	12 11 10	11 11 9.4	0.9 <1 0.5	12 12.3 --	46 44 31
PS-MW-8 (D-2-4)9aac-3	09-01-87	18.5	1,470	6.8	USGS State EPA	52 -- --	-- -- --	220 220 228	31 32 32.2	49 48 48.8	6.2 7 7.49	160 155 --	490 490 --	490 490 --
	12-01-87	11.0	1,310	6.6	USGS State EPA	55 57 --	-- 70 --	190 200 203	27 26 30.3	42 44 49.9	5 6 6.16	140 132 --	440 430 --	440 430 --
	02-25-88	10.0	1,230	7.0	USGS State EPA	57 59 --	-- -- --	180 190 183	27 27 26.1	30 39 37.4	5.5 6 5.8	140 135 --	430 410 --	430 410 --
	04-12-88	15.0	1,410	6.3	USGS State EPA	56 56 50	-- 68 --	220 230 --	33 30 27.9	49 49 42.9	7 6 4.8	160 171 170	520 520 512	520 520 512
PS-MW-9 (D-2-4)10bab-1	09-02-87	15.0	1,450	7.2	USGS State EPA	213 -- --	-- -- --	190 200 206	32 32 32.8	57 64 68.1	2.6 3 2.65	130 147 --	340 330 --	340 330 --
	12-02-87	13.0	1,350	6.7	USGS State EPA	130 218 --	-- 266 --	190 210 164	31 33 26.8	63 60 48.7	2.6 3 2.19	150 135 --	330 340 --	330 340 --
	02-25-88	8.0	1,260	7.1	USGS State EPA	196 --	-- --	170 173	30 29.1	50 47.4	2 1.9	170 --	270 --	270 --
	04-13-88	11.0	1,500	7.2	USGS State EPA	213 212 195	-- 259 --	210 220 200	38 37 33.6	64 66 59	2.3 2 1.6	220 227.5 207	390 330 --	390 330 --



Table 9.—Chemical analyses of

Location	Date of sample	Temperature, field (°C)	Specific conductance, field (µS/cm)	pH, field	Reporting agency	Alkalinity, lab (mg/L as CaCO <sub>3</sub> )	Bicarbonate (mg/L)	Carbonate (mg/L)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Potassium, dissolved (mg/L as K)	Chloride, dissolved (mg/L as Cl)	Sulfate, dissolved (mg/L as SO <sub>4</sub> )
PS-MW-10 (D-2-4)3cd-1	09-03-87	14.0	1,120	7.3	USGS State EPA	230 -- --	-- -- --	-- -- --	140 130 140	35 36 36.3	46 45 46.9	2.7 3 3.13	90 92.4 --	230 230 --
	12-02-87	10.0	965	7.1	USGS State EPA	222 223 --	-- 272 --	-- 0 -	130 130 131	37 39 38.5	38 41 40.9	1.9 2 1.95	100 83.9 --	190 84 --
	02-26-88	8.0	940	7.2	USGS State EPA	203 --	-- --	-- --	120 113	35 32.8	35 33.8	2 1.2	101 --	160 --
	04-13-88	7.0	1,130	7.2	USGS State EPA	229 227 215	-- 277 --	-- 0 --	150 150 141	41 41 38.8	43 43 40.9	2.2 2 1.3	110 115 95	260 250 251
PS-MW-11 (D-2-4)3cc-1	09-03-87	11.5	1,920	6.7	USGS State EPA	264 -- --	-- -- --	-- -- --	290 320 330	57 59 58.8	44 42 44.6	2.1 2 1.88	160 155 --	520 500 --
	12-02-87	10.0	1,370	6.8	USGS State EPA	200 --	244 --	0 --	220 204	38 38.1	35 34.3	2 1.93	170 --	300 --
	02-26-88	7.0	1,260	6.5	USGS State EPA	170 --	-- --	-- --	92 88.8	24 22.8	16 14.7	1 1.2	38.9 --	130 --
	04-14-88	9.0	1,220	6.5	USGS State EPA	172 170 160	-- 208 --	-- 0 --	180 190 165	35 34 30.2	28 28 24.2	1.5 2 0.5	180 187.5 167	250 240 244
PS-MW-11d (D-2-4)3cdc-1	02-26-88	9.0	648	7.6	USGS State EPA	166 170 --	-- -- --	-- -- --	95 92 88.8	24 24 22.8	16 16 14.7	1.6 1 1.2	38 38.9 --	130 130 --
	04-14-88	8.5	682	9.0	USGS State EPA	171 170 --	-- 208 --	-- 00 --	91 89 81	24 24 20.9	16 16 13.9	1.3 1 <0.5	38 39 35	140 130 122
PS-MW-12 (D-2-4)9acc-1	08-31-87	13.0	525	7.8	USGS State EPA	92 -- --	-- -- --	-- -- --	68 67 64.8	18 18 17.6	12 12 11.5	1.1 1 <0.5	40 37.5 --	85 83 --
	11-30-87	9.0	530	6.9	USGS State EPA	119 --	146 --	0 --	72 74.2	20 20.3	10 11	<1 1.11	96.9 --	190 --
	02-23-88	8.5	555	7.6	USGS State EPA	117 --	-- --	-- --	73 67.5	19 18.1	10 9.4	1 1	37 --	94 --
	04-11-88	13.0	580	6.8	USGS State EPA	119 119 110	-- 145 --	-- 0 --	74 70 65.8	20 20 18.2	10 10 9.3	1 0.5	38 39.5 40	96 90 --

water from wells and drains—Continued

Alum- inum, Arsenic, dis- solved ( $\mu\text{g/L}$ as Al)	Ber- ylium, dis- solved ( $\mu\text{g/L}$ as Ba)	Barium, dis- solved ( $\mu\text{g/L}$ as Be)	Cad- mium, dis- solved ( $\mu\text{g/L}$ as Cd)	Chro- mium, dis- solved ( $\mu\text{g/L}$ as Cr)	Cobalt, dis- solved ( $\mu\text{g/L}$ as Co)	Copper, dis- solved ( $\mu\text{g/L}$ as Cu)	Cyan- ide, Total ( $\mu\text{g/L}$ as Cn)	Iron, dis- solved ( $\mu\text{g/L}$ as Fe)	Lead, dis- solved ( $\mu\text{g/L}$ as Pb)	Manga- nese, dis- solved ( $\mu\text{g/L}$ as Mn)	Mercury, dis- solved ( $\mu\text{g/L}$ as Hg)	Nickel, dis- solved ( $\mu\text{g/L}$ as Ni)	Silver, dis- solved ( $\mu\text{g/L}$ as Ag)	Zinc, dis- solved ( $\mu\text{g/L}$ as Zn)			
--	<1	110	<0.5	7	<5	<3	<10	--	6	40	1,100	--	<10	<1	1,900		
<400	28	110	<1	7	<30	<20	<20	<20	<100	30	1,100	<0.2	--	<2	1,800		
<100	23.2	110	<4	8.6	<9	<7	18.5	<10	<100	43.4	1,130	<0.2	<6	9.7	1,950		
--	11	93	<0.5	3	<5	<3	<10	--	6	20	430	--	<10	<1	650		
<400	13	91	<1	3	<5	<20	<20	<20	21	15	420	0.2	<10	<2	680		
<90	11	94	<2	3.8	<10	<25	<8	<10	28	22	442	0.52	<22	<6	697		
<200	11	75	<1	2	<5	<9	<20	<20	28	15	380	14.9	<10	<2	610		
<100	9	88	<4	8.9	<9	<9	22	<1	<100	20	389	0.2	<7	<8	614		
--	10	100	<0.5	6	<5	<3	<10	--	19	30	1,300	--	<10	<1	1,900		
<400	14	91	<1	7	<5	<20	<20	<20	20	20	1,200	0.2	<10	<2	1,800		
<100	9.6	88	<2	5	4.1	<6	22	<10	114	31	1,220	<0.2	<11	<5	1,930		
--	<1	81	<0.5	<1	<5	<6	<10	--	28	<10	550	--	<10	<1	13		
<400	1.5	68	<1	3	<30	<20	<20	<20	<100	<5	570	<0.2	<1	<2	18.0		
<100	4.6	67.4	<4	<4	<9	<7	<17	<10	<100	<2	577	<0.2	<6	<7	9.9		
<400	<1.1	37	<1	<1	<0.9	<5	<20	<20	<20	<5	240	0.37	<10	<2	<20		
1,000	<2	42	<2	<10	<25	<25	<8	<10	--	5	320	<0.2	<22	<6	31		
<200	<1	29	<1	<1	1.2	<5	<20	23	<20	120	<5	140	<0.2	<10	<2	47	
<100	<3	<45	<4	<1	1.2	<9	<9	<13	11	115	2.9	141	0.34	<7	<8	<20	
--	<1	34	<0.5	<1	<1	<5	<3	<10	--	3	<10	130	--	<10	<1	11	
<400	<1	25	<1	<1	<1.1	<4	<20	<20	<20	<100	<5	120	<0.2	<10	<2	<20	
<100	<2	--	<2	<1.1	<1.1	<6	<6	25	<10	<3	118	<0.2	<11	<5	38		
--	2	59	<0.5	2	<5	<3	<3	<10	--	8	<10	500	--	<10	<1	6	
<200	<1	52	<1	<1	1.5	<5	<5	<8	<20	<1	<100	<5	480	<0.2	<10	<2	39
<100	<3	48	<4	<4	1.5	<9	<9	<12	<1	<100	11	482	0.2	<7	<8	<20	
--	2	60	<0.5	<1	<5	<5	<3	<3	<10	--	3	<10	260	--	<10	<1	3
<400	<1	51	<1	<1	<1.1	<4	<5	<8	<20	<20	<5	250	<0.2	<10	<2	<20	
<100	2.6	56	<2	<2	<1.1	<4	<6	<6	29	<10	118	3.1	244	<0.2	<11	<5	13
--	1	65	<0.5	<1	<1	<5	<3	<3	<10	--	10	<10	39	--	<10	<1	38
<400	<1.1	52	<1	<1	1	<9	<8	<7	<20	<10	<5	43	<0.2	<6	<2	40	
135	<6	52.6	<4	<4	<4	<9	<7	<17	<10	<100	2.75	39.4	<0.2	<6	7.6	<7	
<400	25	60	<1	4	0.2	<5	<20	<20	<20	<20	1.3	8	0.3	<10	<2	<20	
90	<2	66	<2	<10	<25	<25	<8	<10	<20	23	<5	8	0.2	<22	<6	17	
<200	2	59	<1	1	0.5	<5	<9	<9	<20	12	<5	28	<0.2	<7	<8	<20	
<100	<3	53	<4	<4	<1	<5	<9	<1	<100	<1	<5	48	<0.2	<7	<8	<20	
--	2	70	<0.5	5	<1	<5	<3	<6	<10	<10	<3	<10	<5	<1	<10	<3	
<400	<1	60	<1	<1	<1.1	<4	<6	<6	<10	<10	<6.5	<5	<7	<0.2	<11	<5	
<100	2.7	57	<2	<2	<1.1	<4	<10	<10	<20	--	<5	1	<0.2	<10	<2	<7	

Table 9.—Chemical analyses of

Location	Date of sample	Temper-ature, field (°C)	Specific conductance, field ( $\mu\text{s}/\text{cm}$ )	pH, field (units)	Report-ing-agency	Alka-linity, lab (mg/L as $\text{CaCO}_3$ )	Bi-carbo-nate (mg/L)	Carbo-nate (mg/L)	Cal-cium, dis-solved (mg/L as Ca)	Magne-sium, dis-solved (mg/L as Mg)	Sodium, dis-solved (mg/L as Na)	Potas-sium, dis-solved (mg/L as K)	Chlo-ride, dis-solved (mg/L as Cl)	Sul-fate, dis-solved (mg/L as $\text{SO}_4^{2-}$ )
PS-DR-1 (D-2-4)3add	09-02-87	15.0	1,610	6.6	USGS State EPA	96 -- --	-- -- --	-- 250 263	240 34 35.5	31 53 55.9	4.8 5 5.98	150 150 --	560 550 --	
	12-02-87	10.0	1,570	6.4	USGS State EPA	104 104 --	-- 128 --	0 240 208	-- 32 28.5	-- 51 44.2	4.6 4 4.48	160 156 --	520 500 --	
	02-22-88	8.0	1,470	6.5	USGS State EPA	114 114 --	-- -- --	200 210 197	30 30 28.7	64 73 66.3	4.3 4 4	190 190 --	410 400 --	
	04-13-88	8.0	1,500	6.4	USGS State EPA	91 91 80	-- 111 --	-- 0 --	240 250 215	34 33 32.6	41 52 47.3	4.5 4 3.4	170 172.5 197	520 510 522
PS-DR-2 (D-2-4)3add	09-02-87	16.0	1,070	6.8	USGS State EPA	94 -- --	-- -- --	-- 150 159	150 39 39.5	15 14 14.6	2.2 2 2.07	39 40.0 --	330 330 --	
	12-02-87	8.5	1,530	6.8	USGS State EPA	313 --	382 --	0 240 226	47 47.4	44 43.3	3 2.94	172 --	270 --	

## water from wells and drains—Continued

Alum- inum, Arsenic, dis- solved ( $\mu\text{g/L}$ as Al)	Beryl- ium, dis- solved ( $\mu\text{g/L}$ as Ba)	Barium, dis- solved ( $\mu\text{g/L}$ as Be)	Cad- mium, dis- solved ( $\mu\text{g/L}$ as Cd)	Chro- mium, dis- solved ( $\mu\text{g/L}$ as Cr)	Cobalt, dis- solved ( $\mu\text{g/L}$ as Co)	Copper, dis- solved ( $\mu\text{g/L}$ as Cu)	Cyan- ide, Total ( $\mu\text{g/L}$ as Crn)	Iron, dis- solved ( $\mu\text{g/L}$ as Fe)	Lead, dis- solved ( $\mu\text{g/L}$ as Pb)	Manga- nese, dis- solved ( $\mu\text{g/L}$ as Mn)	Mercury, dis- solved ( $\mu\text{g/L}$ as Hg)	Nickel, dis- solved ( $\mu\text{g/L}$ as Ni)	Silver, dis- solved ( $\mu\text{g/L}$ as Ag)	Zinc, dis- solved ( $\mu\text{g/L}$ as Zn)	
-- <400 <100	1 13.5 7.59	33 25 40	<0.5 1 <4	18 32 18.6	<5 <30 <9	<3 <20 <7	<10 <20 <10	-- 860 750	740 <5 <2	1,000 980 1,050	-- <0.2 <0.2	<10 -- <6	<1 <2 <7	3,600 3,500 3,980	
-- <400 94	5 5.5 3.9	-- 21 20	-- <1 <2	-- 15 27	-- <5 <10	-- <20 <25	-- <20 <8	-- 290 301	-- <5 7	-- 630 574	-- <0.2 0.2	-- 10 <22	-- <2 <6	-- 2,700 2,460	
-- <200 <100	7 7 5.2	27 22 <45	<0.5 <1 4	11 8 24	<5 <5 <9	<3 <20 <9	<10 <20 <16	- 470 480 491	-- <10 <5 11	890 840 875	-- <0.2 0.3	<10 <10 <7	<1 <2 8	2,000 1,900 2,050	
-- <400 <100	2 <1 <2	27 18 16	<0.5 <1 <2	19 19 12	<5 <5 5	<3 <20 <6	<10 <20 <19	-- 120 120 287	<10 560 <5 4.4	560 530 531	-- <0.2 <0.2	<10 <10 <11	<1 <2 <5	3,000 2,800 2,860	
-- <400 <100	10 4.5 4.6	56 50 49.9	<0.5 2 <4	1 -- <4	<5 <30 <9	<3 <20 <7	<10 <20 <10	-- 1,800 -- 1,860	<10 560 <5 <2	560 560 575	-- <0.2 <0.2	<10 -- <6	<2 <2 8.7	130 450 116	
<400 90	7.5 7.8	69 81	<1 <2	1 1.5	<5 <10	<20 <25	<20 <8	<20 <10	6,100 6,510	<5 5.1	2,000 2,190	<0.2 0.2	<10 <22	<2 <6	240 245

Table 10.—Chemical analyses of total recoverable metals from tailings  
 [Constituents in parts per million; USGS, U.S. Geological Survey;  
 State, Utah Department of Health; >, greater than]

Location:	PS-MW-3	PS-MW-5	PS-MW-5
Tailings Interval:	1.0-2.0 ft	1.0-1.5 ft	4.5-5.5 ft
	State	State	State
Arsenic	380	410	480
Barium	210	94	57
Cadmium	190	83	88
Chromium	57	36	31
Copper	710	680	570
Iron	22,000	20,000	17,000
Lead	13,000	6,800	9,300
Manganese	2,000	2,100	2,400
Mercury	3.7	4.5	4.3
Silver	67	52	57
Zinc	23,000	16,000	17,000

Location:	PS-MW-5	PS-MW-5	PS-MW-9	
Tailings Interval:	5.5-7.0 ft	7.5-9.0 ft	1.5-2.0 ft	
	USGS	State	USGS	State
Arsenic	470	380	400	390
Barium	290	59	120	300
Cadmium	77	92	82	60
Chromium	53	32	33	55
Copper	840	540	660	9
Iron	—	22,000	16,000	32,000
Lead	9,400	7,000	7,700	6,700
Manganese	2,300	1,900	2,100	2,100
Mercury	13	2.3	3.8	—
Silver	68	59	55	50
Zinc	18,000	15,000	15,000	13,000

Table 10.—Chemical analyses of total recoverable metals  
from tailings—Continued

Location: Tailings Interval:	PS-MW-9		PS-MW-9	
	USGS	State	USGS	State
Arsenic	500	530	450	430
Barium	39	18	27	66
Cadmium	110	130	180	77
Chromium	42	29	39	33
Copper	23	730	29	630
Iron	100,000	>76,000	120,000	34,000
Lead	8,700	9,400	9,800	8,300
Manganese	2,100	1,800	1,900	1,900
Mercury	—	3.0	—	4.5
Silver	55	53	65	50
Zinc	23,000	19,000	34,000	13,000

TABLE 11  
 STATISTICAL EVALUATION  
 ROUND I - ARSENIC  
 ALL CONCENTRATIONS ARE EXPRESSED AS Ug/l

UPGRADIENT WELLS				<u>USGS</u>	Detection Limit Used as Such
	USGS	State	EPA		T* = 1.000
MW1S	<1	<1.1	<6		Tc = 1.86
MW1D	<1	<1.1	<6		Not Significant
MW12	<1	<1.12	<6		

DOWNGRADIENT WELLS				<u>USGS</u>	Detection Limit = 1/2
	USGS	State	EPA		T* = 1.000
MW2	<1	<1.1	<6		Tc = 1.86
MW3	<1	<1.1	<6		Not Significant
MW4	<1	<1.1	<6		
MW5	<1	1.2	<6		
MW6	<1	<1.2	<6		
MW7	<1	<1.5	<6		
MW8	<1	<1.1	<6		
MW9	5	6.5	<6		
MW11	<1	1.5	<6		

				<u>STATE</u>	Detection Limit Used as Such
	USGS	State	EPA		T* = 1.1966
MW2	<1	<1.1	<6		Tc = 1.8601
MW3	<1	<1.1	<6		Not Significant
MW4	<1	<1.1	<6		
MW5	<1	1.2	<6		
MW6	<1	<1.2	<6		
MW7	<1	<1.5	<6		
MW8	<1	<1.1	<6		
MW9	5	6.5	<6		
MW11	<1	1.5	<6		

				<u>EPA</u>	Detection Limit Used as Such
	USGS	State	EPA		No Data Variability - Not Significant
MW2	<1	<1.1	<6		
MW3	<1	<1.1	<6		
MW4	<1	<1.1	<6		
MW5	<1	1.2	<6		
MW6	<1	<1.2	<6		
MW7	<1	<1.5	<6		
MW8	<1	<1.1	<6		
MW9	5	6.5	<6		
MW11	<1	1.5	<6		

				<u>EPA</u>	Detection Limit = 1/2
	USGS	State	EPA		No Data Variability
MW2	<1	<1.1	<6		
MW3	<1	<1.1	<6		
MW4	<1	<1.1	<6		
MW5	<1	1.2	<6		
MW6	<1	<1.2	<6		
MW7	<1	<1.5	<6		
MW8	<1	<1.1	<6		
MW9	5	6.5	<6		
MW11	<1	1.5	<6		

ROUND I - CADMIUM  
ALL CONCENTRATIONS ARE EXPRESSED AS Ug/l

UPGRADIENT WELLS

	USGS	State	EPA
MW1S	<1	<1	<4
MW1D	<1	*19	<4
MW12	<1	1	<4

USGS  
Detection Limit Used as Such  
 $T^* = 2.1838$   
 $T_c = 1.8600$   
Significant

DOWNGRADIENT WELLS

	USGS	State	EPA
MW2	<1	1	<4
MW3	<1	<1	<4
MW4	5	6	6.4
MW5	6	*39	7.1
MW6	6	*355	5.9
MW7	8	15	8.1
MW8	20	29	17.9
MW9	<1	<1	<4
MW11	<1	3	<4

Detection Limit = 1/2  
 $T^* = 2.2521$   
 $T_c = 1.8600$   
Significant  
STATE  
Not Enough Data to Do the  
Statistical Calculations

EPA  
Detection Limit Used as Such  
 $T^* = 1.9093$   
 $T_c = 1.8600$   
Significant

Detection Limit = 1/2  
 $T^* = 2.2957$   
 $T_c = 1.8600$   
Significant

ROUND I - CHROMIUM  
ALL CONCENTRATIONS ARE EXPRESSED AS Ug/l

UPGRADIENT WELLS

	USGS	State	EPA
MW1S	<5	<30	<9
MW1D	<5	<30	<9
MW12	<5	<30	<9

USGS  
Detection Limit Used as Such  
No Data Variability  
Not significant

DOWNGRADIENT WELLS

	USGS	State	EPA
MW2	<5	<30	<9
MW3	<5	<30	<9
MW4	<5	<30	<9
MW5	<5	<30	<9
MW6	<5	<30	<9
MW7	<5	<30	<9
MW8	<5	<30	<9
MW9	<5	<30	<9
MW11	<5	<30	<9

Detection Limit = 1/2  
No Data Variability  
Not significant

STATE  
Detection Limit Used as Such  
No Data Variability  
Not significant

Detection Limit = 1/2  
No Data Variability  
Not significant

EPA  
Detection Limit Used as Such  
No Data Variability  
Not significant

Detection Limit = 1/2  
No Data Variability  
Not significant

ROUND I - MANGANESE  
ALL CONCENTRATIONS ARE EXPRESSED AS ug/l

**UPGRADIENT WELLS**

	USGS	State	EPA
MW1S	110	94	99.1
MW1D	460	430	434
MW12	39	43	39.4

USGS

All Values Above Detection Limit  
 $T^* = 1.0211$   
 $T_c = 2.3977$   
 Not Significant

**DOWNGRADIENT WELLS**

	USGS	State	EPA
MW2	110	110	79.7
MW3	6	8	8.8
MW4	300	300	317
MW5	120	120	126
MW6	440	440	456
MW7	250	240	248
MW8	430	420	441
MW9	1300	1500	1400
MW11	550	570	577

STATE

All Values Above Detection Limit  
 $T^* = 1.1618$   
 $T_c = 2.2848$   
 Not Significant

EPA

All Values Above Detection Limit  
 $T^* = 1.1585$   
 $T_c = 2.3236$   
 Not Significant

ROUND I - ZINC  
ALL CONCENTRATIONS ARE EXPRESSED AS Ug/l

**UPGRADIENT WELLS**

	USGS	State	EPA
MW1S	19	25	22.5
MW1D	12	19	<7
MW12	38	40	<7

USGS

All Values Above Detection Limit  
 $T^* = 2.870$   
 $T_c = 1.8604$   
Significant

**DOWNGRADIENT WELLS**

	USGS	State	EPA
MW2	30	26	<7
MW3	6	<15	<7
MW4	1800	1700	1940
MW5	2300	2100	2460
MW6	1100	1100	1210
MW7	2000	2000	2200
MW8	2900	2800	3210
MW9	10	<15	7.7
MW11	13	18	9.9

STATE

Detection Limit Used as Such  
 $T^* = 2.8766$   
 $T_c = 1.8603$   
Significant

Detection Limit = 1/2  
 $T^* = 2.8673$   
 $T_c = 1.8603$   
Significant

EPA

Detection Limit Used As Such  
 $T^* = 2.8774$   
 $T_c = 1.8602$   
Significant

Detection Limit = 1/2  
 $T^* = 2.8790$   
 $T_c = 1.8602$   
Significant

ROUND II - ARSENIC  
ALL CONCENTRATIONS ARE EXPRESSED AS Ug/l

**UPGRADIENT WELLS**

	USGS	State	EPA	USGS
MW1S	N/A	<1.1	<2	Not Enough Data
MW1D	N/A	<1.1	<2	
MW12	N/A	25	<2	

**DOWNGRADIENT WELLS**

	USGS	State	EPA	STATE
MW2	N/A	<1.1	<2	Detection Limit Used as Such
MW3	N/A	1.1	<2	$T^* = 0.9442$
MW4	N/A	<1.1	<2	$T_c = 2.9169$
MW5	1	<1.1	<2	Not Significant
MW6	1	<1.1	<2	
MW7	2	<1.1	2.1	Detection Limit = 1/2
MW8	1	<1.1	3.8	$T^* = 0.9302$
MW9	5	5	3.4	$T_c = 2.9162$
MW11	N/A	<1.1	<2	Not Significant

EPA  
Detection Limit Used As Such  
 $T^* = 1.5556$   
 $T_c = 1.8600$   
Not Significant

Detection Limit = 1/2  
 $T^* = 1.8418$   
 $T_c = 1.8600$   
Not Significant

N/A = No Sample was collected for analysis.

ROUND II - CADMIUM  
ALL CONCENTRATIONS ARE EXPRESSED AS ug/l

UPGRADIENT WELLS

	USGS	State	EPA	<u>USGS</u>
MW1S	N/A	*175	0.7	Not Enough Data
MW1D	N/A	*75	1.3	
MW12	N/A	4	0.2	

DOWNGRADIENT WELLS

	USGS	State	EPA	<u>STATE</u>
MW2	N/A	*80	0.4	Not Enough Data
MW3	N/A	*35	0.2	
MW4	N/A	3	3.2	
MW5	3	*35	3.1	
MW6	7	*355	5.8	
MW7	8	8	9.8	All Values Above Detection Limit
MW8	15	12	16	T* = 2.0099
MW9	<1	<5	0.2	Tc = 1.8922
MW11	N/A	<1	0.9	Significant

N/A = No Sample was collected for analysis

ROUND II - CHROMIUM  
ALL CONCENTRATIONS ARE EXPRESSED AS Ug/l

UPGRADIENT WELLS

	USGS	State	EPA	<u>USGS</u>
MW1S	N/A	<5	<10	Not Enough Data
MW1D	N/A	<5	<10	
MW12	N/A	<5	<10	

DOWNGRADIENT WELLS

	USGS	State	EPA	<u>STATE</u>
MW2	N/A	<5	<10	No Data Variability
MW3	N/A	<5	<10	Not Significant
MW4	N/A	<5	<10	
MW5	<5	<5	<10	
MW6	<5	<5	<10	
MW7	<5	<5	<10	
MW8	<5	<5	15	
MW9	<5	<5	<10	No Data Variability
MW11	N/A	<5	<10	EPA Not Significant

N/A - No Sample was collected for analysis.

ROUND II - MANGANESE  
ALL CONCENTRATIONS ARE EXPRESSED AS ug/l

UPGRADIENT WELLS				<u>USGS</u>
	USGS	State	EPA	
MW1S	N/A	90	99	Not Enough Data
MW1D	N/A	75	80	
MW12	N/A	8	8	

DOWNGRADIENT WELLS				<u>STATE</u>
	USGS	State	EPA	
MW2	N/A	30	20	All Values Above Detection Limits
MW3	N/A	6	5	$T^* = 2.0450$
MW4	N/A	1800	2250	$T_c = 1.8736$
MW5	260	260	276	Significant
MW6	270	280	287	
MW7	59	68	70	
MW8	430	430	472	
MW9	1300	1500	1400	<u>EPA</u>
MW11	N/A	240	320	All Values Above Detection Limit
				$T^* = 1.9788$
				$T_c = 1.8725$
				Significant

N/A = No Sample was collected for analysis.

ROUND II - ZINC  
ALL CONCENTRATIONS ARE EXPRESSED AS ug/l

**UPGRADIENT WELLS**

	USGS	State	EPA	<u>USGS</u>
MW1S	N/A	69	71	Not Enough Data
MW1D	N/A	<20	85	
MW12	N/A	<20	17	

**DOWNGRADIENT WELLS**

	USGS	State	EPA	<u>STATE</u>
MW2	N/A	41	22	Detection Limit Used as Such
MW3	N/A	20	16	$T^* = 2.4806$
MW4	N/A	640	759	$T_c = 1.8623$
MW5	880	930	899	Significant
MW6	1200	1400	1300	
MW7	2100	2400	2150	Detection Limit = 1/2
MW8	2600	2700	2890	$T^* = 2.4814$
MW9	7	<20	16	$T_c = 1.8633$
MW11	N/A	<20	31	Significant

EPA

All Values Above Detection Limit  
 $T^* = 2.4009$   
 $T_c = 1.8637$   
 Significant

N/A = No sample was collected for analysis.

ROUND III

Not Enough Data to Do Statistical Evaluation.  
One Background Well (MW1S) Was Not Sampled.

Round III - Arsenic  
All Concentrations are expressed as Ug/l

UPGRADIENT WELLS

	USGS	STATE	EPA	STATISCAL EVALUATION
MW1S	N/A	N/A	N/A	WAS NOT DONE DUE TO
MW1D	N/A	<1	<3	INSUFFICIENT DATE
MW12	N/A	2	<3	

DOWNGRADIENT WELLS

MW2	N/A	<1	<3
MW3	N/A	<1	<3
MW4	N/A	1	<3
MW5	<1	<1	<3
MW5D	<1	<1	<3
MW6	2	<1	<3
MW7	<1	<1	<3
MW7D	2	<1	<3
MW8	<2	<1	<3
MW9	N/A	2	<3
MW11	N/A	<1	<3
MW11D	2	<1	<3

N/A = No sample was collected for analysis

Round III - Cadmium  
All Concentrations are expressed as ug/l

UPGRADIENT WELLS

	USGS	STATE	EPA	STATISCAL EVALUATION WAS NOT DONE DUE TO INSUFFICIENT DATA
MW1S	N/A	N/A	N/A	
MW1D	N/A	<1	<0.5	
MW12	N/A	1	<0.5	

DOWNGRADIENT WELLS

MW2	N/A	<1	1
MW3	N/A	<1	<0.5
MW4	N/A	2	0.5
MW5	3	<1	0.5
MWD	2	<1	0.5
MWG	7	6	5.4
MW7	9	8	24
MW7D	2	<1	<0.5
MW8	<5	14	45
MW9	N/A	<1	*28
MW11	N/A	<1	1.2
MW11D	<5	<1	1.5

N/A = No sample was collected for analysis

ROUND III - Chromium  
All Concentrations are Expressed as Ug/l

UPGRADIENT WELLS

	USGS	STATE	EPA	
MW1S	N/A	N/A	N/A	STATISTICAL EVALUATION WAS NOT
MW1D	N/A	<5	<9	DONE DUE TO INSUFFICIENT DATA
MW12	N/A	<5	<9	

DOWNGRADIENT WELLS

MW2	N/A	<5	<9
MW3	N/A	<5	<9
MW4	N/A	<5	<9
MW5	<5	<5	<9
MW5D	<5	<5	<9
MW6	<5	<5	<9
MW7	<5	<5	<9
MW7D	<5	<5	<9
MW8	<5	14	<9
MW9	N/A	<5	<9
MW11	N/A	<5	<9
MW11D	<5	<5	<9

N/A = No sample was collected for analysis.

Round III - Manganese  
All Concentrations are Expressed as Ug/l

UPGRADIENT WELLS

	USGS	STATE	EPA	STATISTICAL EVALUATION WAS NOT DONE DUE TO INSUFFICIENT DATA
MW1S	N/A	N/A	N/A	
MW1D	N/A	16	14	
MW12	N/A	<5	<8	

DOWNGRADIENT WELLS

MW2	N/A	64	80
MW3	N/A	7	>8
MW4	N/A	2700	2750
MW5	120	120	487
MW5D	500	470	107
MW6	82	85	80
MW7	24	32	29
MW7D	170	160	162
MW8	110	110	114
MW9	N/A	850	889
MW11	N/A	140	141
MW11D	500	480	482

N/A = No sample was collected for analysis.

Round III - Zinc  
All Concentrations are Expressed as Ug/l

UPGRADIENT WELLS

	USGS	STATE	EPA	STATISTICAL EVALUATION WAS NOT DONE DUE TO INSUFFICIENT DATA
MW1S	N/A	N/A	N/A	
MW1D	N/A	44	<20	
MW12	N/A	71	<20	

DOWNGRADIENT WELLS

MW2	N/A	89	20
MW3	N/A	52	<20
MW4	N/A	400	361
MW5	71	97	<20
MW5D	19	59	74
MW6	1100	1100	1060
MW7	2100	2100	2180
MW7D	6	42	<20
MW8	2100	2100	2160
MW9	N/A	51	<20
MW11	N/A	47	<21
MW11D	6	39	<20

N/A = No sample was collected for analysis.

ROUND IV - ARSENIC  
ALL CONCENTRATIONS ARE EXPRESSED AS ug/l

**UPGRADIENT WELLS**

	USGS	State	EPA	<u>USGS</u>
MW1S	N/A	<1	<2	Not Enough Data
MW1D	1	1.5	<2	
MW12	2	1	2.7	

**DOWNGRADIENT WELLS**

	USGS	State	EPA	<u>STATE</u>
MW2	2	<1	<2	Detection Limit Used as Such
MW3	<1	<1.1	<2	$T^* = 0.1629$
MW4	<1	<1.1	<2	$T_c = 2.5417$
MW5	<1	<1.1	<2	Not Significant
MW5D	2	<1.1	<2	
MW6	<1	<1.1	<2	
MW7	2	<1.1	<2	Detection Limit = 1/2
MW7D	3	<1.1	<2	
MW8	<1	<1.1	<2	$T^* = 0.8919$
MW9	4	2.5	2.4	$T_c = 2.6474$
MW11	<1	<1	<2	Not Significant
MW11D	2	<1	2.6	

EPA

Detection Limit Used as Such  
 $T^* = 0.7952$   
 $T_c = 2.8829$   
 Not Significant

Detection Limit = 1/2  
 $T^* = 0.6996$   
 $T_c = 2.8457$   
 Not Significant

N/A = No sample was collected for analysis

ROUND IV - CADMIUM  
ALL CONCENTRATIONS ARE EXPRESSED AS Ug/l

**UPGRADIENT WELLS**

	USGS	State	EPA	USGS
MW1S	N/A	<1	<1.1	Not Enough Data
MW1D	<3	<1	<1.1	
MW12	5	<1	<1.1	

**DOWNGRADIENT WELLS**

	USGS	State	EPA	STATE
MW2	3	<1	<1.1	Detection Limit Used as Such
MW3	<1	<1	<1.1	$T^* = 1.6137$
MW4	9	8	<5.5	$T_c = 1.8120$
MW5	2	*50	3.6	Not Significant
MW5D	<1	<1	<1.1	
MW6	8	8	<5.5	
MW7	7	<1	<5.5	Detection Limit = 1/2
MW7D	3	<1	<1.1	
MW8	22	22	20	$T^* = 1.6340$
MW9	2	<1	<1.1	$T_c = 1.8120$
MW11	<1	<1	<1.1	Not Significant
MW11D	<1	<1	<1.1	

EPA  
Detection Limit Used as Such  
 $T^* = 1.8467$   
 $T_c = 1.7960$   
Significant

Detection Limit = 1/2  
 $T^* = 1.5301$   
 $T_c = 1.7960$   
Not Significant

N/A = No sample was collected for analysis

ROUND IV - CHROMIUM  
ALL CONCENTRATIONS ARE EXPRESSED AS Ug/l

UPGRADIENT WELLS

	USGS	State	EPA	USGS
MW1S	N/A	<5	<4	Not Enough Data
MW1D	<5	<5	<4	
MW12	<5	<5	<4	

DOWNGRADIENT WELLS

	USGS	State	EPA	STATE
MW2	<5	<5	<4	No Data Variability
MW3	<5	<5	4.5	Not Significant
MW4	<5	<5	<4	
MW5	<5	<5	5.2	
MW5D	<5	<5	<4	
MW6	<5	<5	5.1	
MW7	<5	<5	<4	
MW7D	<5	<5	<4	
MW8	<5	<5	<4	
MW9	<5	<5	<4	No Data Variability
MW11	<5	<5	<4	EPA
MW11D	<5	<5	<4	Not Significant

N/A = No sample was collected for analysis.

ROUND IV - MANGANESE  
ALL CONCENTRATIONS ARE EXPRESSED AS Ug/l

**UPGRADIENT WELLS**

	USGS	State	EPA	<u>USGS</u>
MW1S	N/A	22	28	Not Enough Data
MW1D	9	12	14	
MW12	1	<5	<7	

**DOWNGRADIENT WELLS**

	USGS	State	EPA	<u>STATE</u>
MW2	3	<5	7.3	Detection Limit Used as Such
MW3	13	13	7.8	$T^* = 1.9624$
MW4	46	46	44	$T_c = 1.7994$
MW5	2	44	47	Significant
MW5D	88	86	82	
MW6	*5	57	63	
MW7	7	11	14	Detection Limit = 1/2
MW7D	430	420	383	
MW8	130	120	115	$T^* = 1.9676$
MW9	1200	1100	1100	$T_c = 1.8004$
MW11	130	120	118	Significant
MW11D	260	250	244	

EPA  
Detection Limit Used as Such  
 $T^* = 1.8950$   
 $T_c = 1.8014$   
Significant

Detection Limit = 1/2  
 $T^* = 1.9066$   
 $T_c = 1.8031$   
Significant

N/A = No sample was collected for analysis

ROUND IV - ZINC  
ALL CONCENTRATIONS ARE EXPRESSED AS ug/l

**UPGRADIENT WELLS**

	USGS	State	EPA	<u>USGS</u>
MW1S	N/A	<20	14	Not Enough Data
MW1D	5	20	48	
MW12	3	<20	<7	

**DOWNGRADIENT WELLS**

	USGS	State	EPA	<u>STATE</u>
MW2	3	<20	<7	Detection Limit Used as Such
MW3	12	26	9.1	$T^* = 2.7090$
MW4	2300	2400	2290	$T_c = 1.7960$
MW5	*3	1900	1780	Significant
MW5D	6	<20	8.8	
MW6	1500	1600	1540	
MW7	2100	2100	2030	Detection Limit = 1/2
MW7D	3	<20	8.1	
MW8	3000	2900	2780	$T^* = 2.2666$
MW9	6	<20	16	$T_c = 1.7961$
MW11	11	<20	38	Significant
MW11D	3	<20	13	

EPA  
Detection Limit Used as Such  
 $T^* = 2.6759$   
 $T_c = 1.7978$   
Significant

Detection Limit = 1/2  
 $T^* = 2.6778$   
 $T_c = 1.7980$   
Significant

N/A = No sample was collected for analysis.

BSHW/5169z/1-21

ATTACHMENT A  
DRILLING REPORT

~~DRAFT~~

~~DRAFT~~

DRILLING ACTIVITIES REPORT  
FOR PROSPECTOR SQUARE, PARK CITY, UTAH

The Silver Creek Tailings/Prospector Square site is located within the city limits of Park City approximately 30 miles east of Salt Lake City. The site is currently being investigated by the state of Utah and EPA through a memorandum of agreement (Appendix B). The USGS Water Resources Branch and Ecology and Environment Inc. Field Investigation Team were requested by the two principle investigators to conduct a drilling and well installation program at the site. The USGS was requested by the state of Utah to oversee well installation at the Silver Creek site, while E&E was requested to subcontract the drilling and to supervise the drilling program.

There were three phases of the drilling conducted at Prospector Square, Park City, Utah. The first phase was conducted during July 15-23, 1987. The second phase was conducted during July 27-August 5, 1987 and the third phase was conducted during August 13-21, 1987. The drilling was subcontracted to the Earth Data Acquisition Group (EDAG) of Denver, Colorado under TDD F08-8611-34D.

FIT arrived onsite July 15, 1987 at 8:00 a.m. and met with Jim Mason, United States Geological Survey (USGS) and Alton Schoonmaker of EDAG, topics of discussion were the site safety plan and proposed drilling schedule. The site safety meeting was conducted, all participants signed the release form and drilling began on PS-MW-16 at 10:30 a.m. EDAG was equipped with a CME-75 hollow stem auger rig (HSA) with a downhole hammer. Prior to commencing drilling, the USGS, in conjunction with Park City representatives had utilities checked and received final permission from Park City Engineer, Ron Ivie to drill and install wells on city property.

#### A. SHALLOW ALLUVIAL MONITORING WELLS

Eleven shallow monitoring wells were installed at various locations in the Prospector Square area (Figure 1). Selection of the well locations were based on professional judgment of the USGS Hydrology Branch, Salt Lake City, Utah. A summary of shallow alluvial well logs and completions is presented in Appendix A.

The objectives of installing the shallow alluvial wells were:

- o To define water table elevations, aquifer permeabilities, gradients and flow directions.
- o To document lateral and vertical extent of contamination.
- o To provide geological information on the subsurface conditions.

Installation of 11 shallow monitoring wells occurred during the three drilling periods. The following is the breakdown, including the date and type of drilling and the number of wells installed.

DATE	TYPE OF DRILLING	WELLS INSTALLED
7/15-7/23/87	Hollow stem auger (HSA)	PS-MW-1s, PS-MW-2, PS-MW-4, PS-MW-6, PS-MW-5s, PS-MW-7 (6)
7/27-8/24/87	HSA	PS-MW-3, PS-MW-9, PS-MW-5 PS-MW-10, PS-MW-1D (5)
8/13-8/21/87	HSA w/casing advancer	PS-MW-2D, PS-MW-11 (2) Boreholes PS-BH-001, PS-BH-002 (2)

A CME 75 hollow stem auger drilling rig was used to drill the above mentioned boreholes. The boreholes were advanced with a 7 5/8" hollow stem auger, with split spoon samples taken at 5.0' intervals unless field conditions warranted otherwise. Samples of the unconsolidated sediments were obtained using a 2', 18" or 24" split spoon barrel. Geologic descriptions of

the samples were made immediately at the time of collection and a detailed geologic log was prepared. Logs are provided in Appendix A.

If a sample was collected for analysis, the sample was composited in a stainless steel bucket, the sample was placed in an 8 ounce glass jar with a teflon lined lid. The sample was labeled with the appropriate sample tag including the samples name, the date, TDD #, well number and depth. The lid was taped, the sample placed in a plastic sample bag, then placed in appropriate sample containers under chain of custody.

Drill spoils produced during the drilling program were containerized in 55 gallon drums and stored at the Summit County Landfill with permission from Ron Ivie. Spoils were containerized from all boreholes. Screening samples were collected and analyzed by the state lab for metals and E.P. toxicity.

#### B. DEEP ALLUVIAL WELLS

Two deep alluvial wells were installed upgradient of Prospector Square. Well locations were based on locations outlined in the USGS project proposal for Prospector Square. A summary of deep alluvial well logs and completions are presented in Appendix A.

The objectives of installing the deep alluvial wells were:

- o To determine baseline water quality in the deep alluvium upgradient of Prospector Square.
- o To provide geologic information of the alluvium beneath the shallow aquifer and wells.
- o To determine the hydraulic gradient between the deep and shallow alluvium.

### C. TAILINGS DRILLING

In addition to shallow alluvial wells, two shallow boreholes were drilled to the base of the tailings (PS-BH-001 and PS-BH-002). The locations of the boreholes were chosen to assist in determining the horizontal and vertical distribution of tailings in the Prospector Square area in partial fulfillment of SARA, Section 125. The 2 shallow holes were drilled to depths of 9.6' and 8.0' respectively. The borings were drilled down to native material. The boreholes were backfilled with a mixture of native material and bentonite. Borehole logs are contained in Appendix A.

### D. WELL COMPLETION

Wells were constructed of 2" inside diameter Schedule 80 PVC casing with either 10 or 20 slot screen. Shallow wells were drilled approximately 15' into the water table and a five foot section of screen was set five feet above the bottom of the well. A five-foot silt trap was installed below the screen. The annular space around the screens were backfilled with 10/20 Colorado silica sand to five feet above the screen. A minimum 2 foot bentonite seal was emplaced on the sand and hydrated. The placement of this seal was to prevent any downward migration of surface water. The annular space around the well casing was grouted with cement and 4% bentonite slurry to within 4 feet of the surface. A four feet locking steel surface casing was placed in the hole, and a neat cement surface seal was then emplaced. The casing was set flush with the ground surface.

Deep alluvial wells were installed and completed in the same manner as shallow alluvial wells except for the following procedures:

- o 1 ten foot section of 20 slot screen was set at total depth without the use of a silt trap below the screen.
- o Setting of the bentonite and cement seals was accomplished via a 1" tremie line.

#### E. WELL DEVELOPMENT

The wells were developed by use of a Brainard-Killman pitcher pump. All wells were pumped until temperature, pH, specific conductance and flow rate were constant. Several (3-7) casing volumes of water were evacuated before chemical equilibria was obtained. All development water was containerized and stored at the county landfill pending analysis for hazardous waste characterization.

#### F. DECONTAMINATION

Upon completion and development of each well, equipment used in the drilling process in as steam cleaned and rinsed with water. The steam cleaning was accomplished by using a Hotsry Steam cleaner with a soap and water mixture. The equipment was rinsed with clean water to remove any soap residue.

#### G. WELL SURVEYING

At the direction of E&E, all wells and borings were surveyed to an existing benchmark for horizontal and vertical control by J.J. Johnson and Associates of Park City, Utah. Table 1 contains these data. Water level measurements were recorded subsequent to this survey by the USGS. The USGS will develop a potentiometric map showing ground water flow direction.

## DRILL LOG

PROJECT Prospector SevareTOD NO. 708 - 3611 - 340DATE 8-1-57WELL/BORING PS-11W 1DLOCATION Kearns & Hamer Blk.LOGGER H. FerenczDRILL METHOD HSA - Split Spoon DrillsDepth 0 ft. VTPAGE 1 OF 1WATER LEVEL FIRST ENCOUNTERED 32.2FINAL 33.25ELEV. 6791.87

DEPTH IN FEET	LITH COL	SAMPLE TYPE IDENT.	MOISTURE CONTENT WATER LEVEL	LITHOLOGIC DESCRIPTION	NOTES
10				Fill sand, gravelly, dry, brown Gravel fine to coarse, sandy, clayey, close Med dense to dense, brown to reddish brown, moist, w. ch. clayey lenses at 6, 13-15', 20-25' 24-26', 35' (GC)	Upper 45' was similar to site PS-11W-1A, which was logged with 9 sp. spoon Drills.
30		IV V	Initial Final	Sand, fine to coarse, gravelly, fine to coarse w. cl. scattered cobbles, cl. clayey dense, wet brown (SC-ISP)	
40				More gravelly at 54', 64-65', 66-67'	
50		SS		Clay, low to med. plasticity, soft-silky, fine to coarse grained s. gravelly to scattered gravel with cobbles, very stiff, moist to wet, brown (CL)	Recovery: 50-51.0' = 100% SS = 30-40
60					
70					
80		SS			
90		SS			
100	TOD	85.5'		Shale reddish brown, friable, (Woodside Shale); moderately hard from 85.0'; moist	Recovery: 80 - 82' = 100% SS = 30-6-9-10 Recovery: 85 - 85.5' = 100% SS = 160/por 3", 230/3"

## DRILL LOG

PROJECT Prospector Square JOB NO. FOT 8611-34D DATE 7-16-87  
 WELL/BORING PS - MW - 2 LOCATION Pacific Bridge WELL LOGGER K. Moul  
 DRILL METHOD HSA Split Sptn Drives PAGE 1 OF 1  
 WATER LEVEL FIRST ENCOUNTERED 31.0' FINAL 32.0 ELEV. 6758.44

DEPTH IN FEET	LITH CBL	SAMPLE TYPE IDENT.	MOISTURE CONTENT WATER LEVEL	LITHOLOGIC DESCRIPTION	NOTES
0	/ / /			Fill, sand gravel, cobbles	
0 - 10	0 0			Gravel, fine-coarse sandy clay medium dense moist with clay lenses cobbles to 6"	Drive 25% Recovery
10 - 20	0 - 0				Drive 80% Recovery
20 - 30	0 0				Drive 100% Recovery
30 - 40	0 - 0	Initial Final		Clay - Brown-red low-medium plasticity, sandy-silt very fine-fine sand small amount gravel well sorted small and silt	Drive 100% Recovery
				- TO 44.5'	Drive 50% Recovery

## DRILL LOG

PROJECT Prospector SquareWELL/BORING PS-MW-2DDRILL METHOD HSA, Air ROTARYWATER LEVEL FIRST ENCOUNTERED 33.0'TDD NO. F08-8611-34DLOCATION West of Corner ShopPark City, UTFINAL 30.0'DATE 8/20-21/87LOGGER M. PeccnyPAGE 1 OF 1

ELEV.

DEPTH IN FEET	LITH COL.	SAMPLE TYPE IDENT.	MOISTURE CONTENT WATER LEVEL	LITHOLOGIC DESCRIPTION	NOTES
2'		I		F.I.: Gravel, sandy, fine to coarse dense, dry, gray (G1)	Some fine grained with sand, gray tailings material observed at the vicinity of the boring
25		HSA cuttings		Gravel, fine to coarse, sandy, fine to coarse, dense, moist, brown, with cobbles (rounded to subangular) (GP)	Core recovery 35.0 - 36.5' = 100%
30		I final		St. clayey to clayey at 20', 25-40' to gravelly clay 40-54' (GC)	
40		SS 12-12-22		Clay, sandy, fine to coarse, stiff, moist, brown, scattered gravel up to cobble size (CL)	
54				Clay, sandy, gravelly fine to coarse, stiff, moist, brown (CL)	
60				Gravel, sand, fine to coarse, clayey, dense, moist, brown (rounded to subangular gravel with cobble) (GC)	Core recovery 90.0 - 91.0' = 80%
71				Stiff, moist, brown (CL)	Bouncing
90		HSA SS 100-200		Stiff, moist, brown (CL)	Start Air rotary at 93'
97	AIR ROTARY			Gravelly sand to sandy gravel, fine to coarse with cobbles, dense moist to wet, brown, scattered clayey lenses (106', 112-113', 111.5-115')	(SP/GP) Water discharge at 110' 0.8 gal/min
110				Some boulders of igneous rock (pinkish) and quartzite between 114-120'	115' 1 gal/min.
120					120' 1.7 gal/min
125.0'	TDD			Shale, reddish brown, silty, fine grained low hardness, wet, sticky, wood inside shale	

Air Rotaty Sampling at 5' interval  
(93' - 125')

## DRILL LOG

PROJECT Prospector Square JOB NO. FDE 2611-340 DATE 7-28-87  
 WELL/BORING PS - MW - 3 LOCATION Highway 224 East of Park City, High Uintas LOGGER R. Moll  
 DRILL METHOD HSA Soil Spans PAGE 1 OF 1  
 WATER LEVEL FIRST ENCOUNTERED 92.45 FINAL 21.97 ELEV. (6743.35)

DEPTH IN FEET	LITH COL	SAMPLE TYPE IDENT.	MOISTURE CONTENT WATER LEVEL	LITHOLOGIC DESCRIPTION	NOTES
0				TOPSOIL Fill, sand, yellow w/ sorted silt limonite staining	Continuous Drives 3.0' intervals 100% recovery
10				Fill Clay, dark brown low plasticity w/ pebbles & gravel	
20				Fill clay - Red-Medium plasticity w/ pebbles & gravel angular	
30			Initial	Clay - Red medium plasticity w/ very fine grained sand & pebbles rounded - angular	Drive 100% recovery
40				Gravel fine - course, angular - subangular poorly sorted Moist	
50				Clay - Brown medium - high plasticity, small amt pebbles	Drive 80% recovery Blow counts 3-4-4
60				Gravel - as above TD 36.0'	Drive 40% recovery

## DRILL LOG

PROJECT Prospector Square JOB NO. FSE 8611-34 D DATE 7-20-87  
 WELL/BORING PS - MW - 4 LOCATION Prospector Square LOGGER K. MOLE  
 DRILL METHOD HSA SPIT Spec @ Silver Creek PAGE 1 OF 1  
 WATER LEVEL FIRST ENCOUNTERED 27.99 FINAL 29.2 ELEV. 6773.42

DEPTH IN FEET	LITH CBL	SAMPLE TYPE IDENT.	MOISTURE CONTENT WATER LEVEL	LITHOLOGIC DESCRIPTION	NOTES
0.0	0.0			Fill Asphalt Pitch Dirt Dark Brown w/ CCOLES SAND - Tan - Beige medium coarse well sorted and rounded	Drive 2.0' samples
10.0	0.0			Gravel fine - medium, sandy, clayey - medium plasticity with fine - medium sand clay lenses throughout pebbles to 1/2"	Drive 100% recovery
20.0	0.0			Clay - Red medium plasticity w/ fine - medium sand interbedded Quartz and K-Spar pebbles to 1/2"	Drive 100% recovery
30.0	0.0	Initial		Gravel fine - coarse angular - subrounded Clay as above	Drive 60% recovery
30.0	0.0	Final		Gravel, sandy fine - coarse moist	Drive 0% recovery
30.0	0.0			NO Return	
40.0	0.0			Sand Reddish - brown fine - medium rounded - Subrounded with CCOLEs, Small amounts Clay lenses	Drive 0% recovery
40.0	0.0			NO Return	
40.0	0.0			Gravel - fine - medium, poorly sorted pebbles with Clay interbedded	Drive 80% recovery
				TD 45.0'	Drive 80% recovery

## DRILL LOG

PROJECT Prospector Square JOB NO. F08 8611-34 D DATE 7-20-87  
 WELL/BORING PS-MW-5 LOCATION SIDEWINDER C LOGGER K. MOLL  
 DRILL METHOD HSA SPLIT SPOON BELLIE STARR PAGE 1 OF 1  
 WATER LEVEL FIRST ENCOUNTERED 22.5 FINAL 18.0 ELEV. 6741.04

DEPTH IN FEET	LITH COL	SAMPLE TYPE IDENT.	MOISTURE CONTENT WATER LEVEL	LITHOLOGIC DESCRIPTION	NOTES
7.5	XXX			. Fill brown clint sand Lt brown-tan, medium-grained well sorted, subrounded same as above, grades to Coarser sand w/ gravel tailings	Drives - 2.0' Continuous G.C. - 8.5'
10.0	○○			Gravel Cobbles to 3" Small subrounded rounded amt Silt + clay Clay lens @ 12.7	Drive 10-12.0 60% recovery
15.0	○○		Final	Clay - Red brown medium plasticity MOIST	
22.5	○○		Initial	Clay fat, Red highly plastic Sand + pebbles interbedded NO Return	0% recovery
30.0	○○			Gravel - cobbles to 4" rounded	400% recovery
35.0				Clay - Red-Brown fat highly plastic w/ interbedded fine - very fine sand TD 34.0'	

## DRILL LOG

PROJECT Prospector Square JOB NO. Fox 2611-34 D DATE 1-20-87  
 WELL/BORING PS - MW-6 LOCATION Dixie Holloway Rd LOGGER K Mehl  
 DRILL METHOD HS A Split Spoons Little Bessie Ave PAGE 1 OF 1  
 WATER LEVEL FIRST ENCOUNTERED 14.0' FINAL 13.0' ELEV. 6731.48

DEPTH IN FEET	LITH COL	SAMPLE TYPE IDENT.	MOISTURE CONTENT WATER LEVEL	LITHOLOGIC DESCRIPTION	NOTES
-				Dirt, dark brown, silty sandy clay	Drives 2.0' continuous B.C. 10, 11, 14, 15
5				Gravel, sandy silt w/ cobbles rounded - subrounded	20% recovery B.C. 4, 6, 11, 25
10				Clay - red silty, medium plasticity dry w/ cobbles	100% recovery B.C. 6, 10, 15, 20
15				Gravel - Quartzite, + serpentine Chips fine - coarse rounded - subrounded good sorting, silty Sand w/ small amt Cobbles	
20				SAME AS ABOVE	
25				Clay - Brown - red medium plasticity, moist 13.0', interbedded lenses v.f. f sand rounded and well sorted	Drive 14.0-16.0 60% recovery
30				SAND - v.f. f, well rounded rounded good sorting with lenses of red brown clay	
35				Gravel - fine - coarse, sand clayey, cobbles - rounded subrounded 1/2"-4"	
				30% return	
				TD 29.0'	

## DRILL LOG

PROJECT Prospector Square JOB NO. F08 8611-34 D DATE 7-20-77  
 WELL/BORING PS - MW - 7 LOCATION Buffalo Bill Ave LOGGER K. Mock  
 DRILL METHOD HSA (spit & spoon) PAGE 1 OF 1  
 WATER LEVEL FIRST ENCOUNTERED 15.2 FINAL 12.0' ELEV. 6722.46

DEPTH IN FEET	LITH COL	SAMPLE TYPE IDENT.	MOISTURE CONTENT WATER LEVEL	LITHOLOGIC DESCRIPTION	NOTES
	X X			Fill sandy, dry, brown w/ small amount clay	Drives 3.0' continuous G.L. - 3.0'
5				Clay - low plasticity, brown pebbles w/ sandy silt	
10				Gravel . coarse-fine sm amt clay cobbles w/ qtz chips. subrounded-rounded poorly sorted, 75% dk minerals dry	
15			Initial ▽ =		Drive 14.0-15.5 30% recovery
20				Gravel . coarse - fine, sandy clay medium plasticity, small amt silt, qtz, ss chips cobbles to 4" subangular-rounded poorly sorted	
25				Sand . fine - medium, tight well sorted rounded to subrounded predominately qtz grainy high plastic clay. fat bluc-grey clay wet	
				TD 25.0	

## DRILL LOG

PROJECT Prospector Square JOB NO. F07 2611-340 DATE 8-4-87  
 WELL/BORING PS-MW-8 LOCATION Comstock - CUL DE SAC LOGGER M. Peccny  
 DRILL METHOD HSA SPLIT Spoons PAGE 1 OF 1  
 WATER LEVEL FIRST ENCOUNTERED 26.6 FINAL  ELEV. 6751.41

DEPTH IN FEET	LITH COL	SAMPLE TYPE IDENT.	MOISTURE CONTENT WATER LEVEL	LITHOLOGIC DESCRIPTION	NOTES
0				Sand, gravelly fine - coarse with cobbles, well sorted dense slightly moist gray Gravel subrounded	5-8-8-9 Bows 100% recovery
10				sandy silt, loose dark brown fine grained - coarse Gravel, fine - coarse, sandy with cobbles dense moist brown silt clayey	12-13-15-10 100% recovery
20				clay - low plasticity, sandy fine coarse silty loose moist brown Gravel - fine - coarse clayey low Plasticity silty, moist dense brown with cobbles subangular	4-5 100% recovery 35-35-50-35 100% recovery
30				silt-clayey, with gravel subangular - subrounded with sand lenses fine - coarse	Drive - 100% recovery 20-40-50/5
40				Gravel - fine - coarse with cobbles Dense, silty, st clayey, moist brown (subangular few subrounded)	Drive 100% recovery 33-50
				TD 41.0'	

## DRILL LOG

PROJECT Prospector Square JOB NO. FOT 8611-34 D DATE 7-29-87  
 WELL/BORING PS - MIN-9 LOCATION City Park east LOGGER K. McEl  
 DRILL METHOD HSA SPLIT SPONS OF Prospector Square PAGE 1 OF 1  
 WATER LEVEL FIRST ENCOUNTERED 12.0 FINAL \_\_\_\_\_ ELEV. 6707.50

DEPTH IN FEET	LITH COL	SAMPLE TYPE IDENT.	MOISTURE CONTENT WATER LEVEL	LITHOLOGIC DESCRIPTION	NOTES
0.0				Tailings. Pyrite, Arsenopyrite Minerals, SAND Fine- Very Fine grained well sorted + rounded	Drives 0-2.0' 2.-4.0' 4.0-6.0' 100% recovery
5.0				Clay- Dark brown organic clay- same as above	
10.0				Gravel - fine-coarse with Gobbles, subrounded rounded, poorly sorted interbedded lenses of sandy clay	
15.0			Initial 	Bedrock, Shale Red friable parts at bedding planes slightly weathered TD 16.5	Drive 15.0-16.0 WOODSIDE Shale 596-5"

## DRILL LOG

PROJECT Prospector Square JOB NO. F08-8611-34 D DATE 7-31-87  
 WELL/BORING PS - MW-10 LOCATION Highway 724, east LOGGER K. MOLL/M. POGGNY  
 DRILL METHOD HSA Split Spoons of Park City PAGE 1 OF 1  
 WATER LEVEL FIRST ENCOUNTERED 1.5' FINAL 2.0' ELEV.

DEPTH IN FEET	LITH COL	SAMPLE TYPE IDENT.	MOISTURE CONTENT WATER LEVEL	LITHOLOGIC DESCRIPTION	NOTES
0	////			Sand fine-coarse, w gravel with silty sand lens	Drives 0-4.0 100% recovery
5	0.0			Gravel - fine-coarse, surrounded poorly sorted	
10	0.0			Gravel - fine-coarse poorly sorted Sub rounded	Drive No Recovery
	6.0			BEDROCK - Shale friable, weathered parts easily @ bedding planes. DARK Reddish brown	Drive 70/6 No Recovery
	0.0			TD 13.0'	

## DRILL LOG

PROJECT Dos Pecos, Equano TDD NO. I0E-8611-34D DATE 8-13-87  
 WELL/BORING 10E-14W-11 LOCATION Eas. from 13th Street  
 DRILL METHOD HCA + Split & Screen Drills LOGGER M. Pacenka  
 WATER LEVEL FIRST ENCOUNTERED 2.8 FINAL 1.77 PAGE 1 OF 1  
 ELEV.

DEPTH IN FEET	LITH COL	SAMPLE TYPE IDENT.	MOISTURE CONTENT WATER LEVEL	LITHOLOGIC DESCRIPTION	NOTES
2			Final	F.I. Silt, gravelly, loose, dry, gray with cobbles	
4			Initial	Silt, fine grained clayey, low plasticity, sl. sandy, med. dense dark brown to black, organic	
8				Clay, highly plastic, sl. sandy to sandy fine grained moist to wet, gray to dark gray	SS = 9-10-11 (per 6" each) Recovery 10.0 - 12.0' = 100%
10					
12				Sand, gravelly, fine to coarse, with scattered cobbles, med. dense, moist to wet, gray	
14					
16					
18					
20					SS = 9-10-12 (per 6" each) Recovery 20-22.0' = 100%
22					

## DRILL LOG

PROJECT Prospector Square.WELL/BORING DS-341 CO1DRILL METHOD Split spoon Drives (SS)WATER LEVEL FIRST ENCOUNTERED DryTDD NO. F08-E611-34DDATE 8-21-87LOCATION Pr. Square NotchLOGGER H. Frenney

Dak City UT

PAGE 1 OF 1FINAL Dry

ELEV.

DEPTH IN FEET	LITH COL	SAMPLE TYPE IDENT.	MOISTURE CONTENT WATER LEVEL	LITHOLOGIC DESCRIPTION	NOTES
1	SS			TOPSOIL Fill - Sandy, gravel, fine to coarse loose, dry, brown, organic. (GP/SP)	Drilled natural soil Recovery 0 - 2' = 100% SS = 3-12-11-11 Blow count
2				Fill - Sand, fine to coarse, silty. sl. clayey, loose to med. dense moist, dark brown; organic to l. organic (SP/SH)	Recovery 2.0 - 4.0 = 100% SS = 6-7-14-14
3	SS				Recovery 4.0 - 6.0 = 100% SS = 9-5-9-9
4					Soil (EPA) sample 3.5 - 4.0 Soil (EPA) sample 4.0 - 5.5
5	SS				Recovery 6.0 - 7.6 = 100% SS = 6-6-30
6	SS				SS = 45-30-45-30 Recovery 7.6 - 9.6 = 100%
7					Note: hole was backfilled with natural soil and road gravel
8	SS				
9					
10	TDD 7.6'				

## DRILL LOG

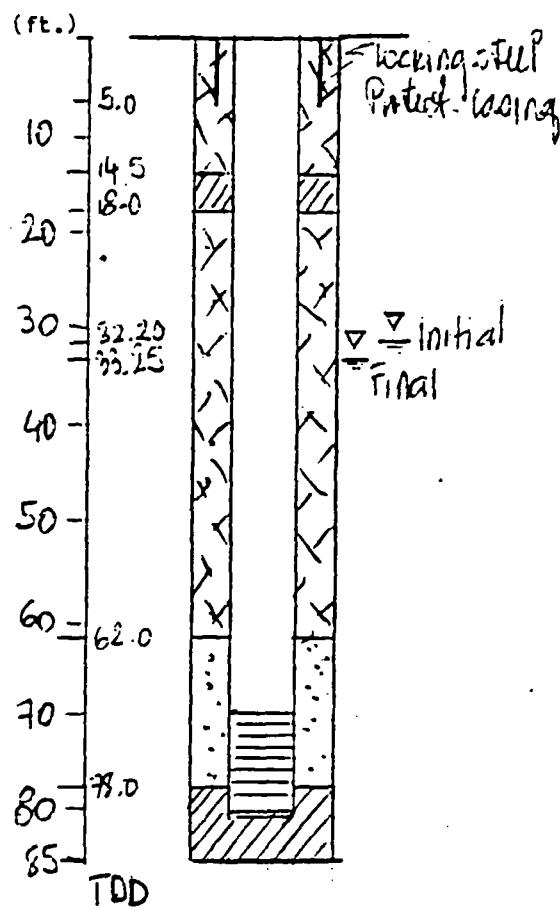
1  
PROJECT Precipice Square  
WELL/BORING 25-34-70'2  
DRILL METHOD Solid & Spoon Drills (SS)  
WATER LEVEL FIRST ENCOUNTERED Dry

TDD NO. F18-8611-34D DATE 8-21-67  
LOCATION P. Square - South Face LOGGER M. Pecony  
FINAL Dry PAGE 1 OF 1  
ELEV. \_\_\_\_\_

DEPTH IN FEET	LITH COL	SAMPLE TYPE IDENT.	MOISTURE CONTENT WATER LEVEL	LITHOLOGIC DESCRIPTION	NOTES
0	11111	1		TOPSOIL Clay, silt, dry, gray	
1	SS			Soil fine to med, granular soft to st. stiff, loose to med. dense	SS = 6-8-12-14 Recovery: 0-2.0' = 100%
2	-			dry to sl. moist, gray with yellowish brown (limonite) lenses rich in pyrite (at 3.5-4.0 'CH)	
3	SS				SS = 6-8-10-10 Recovery: 2.0-4.0' = 100%
4	-				
5	SSI				SS = 7-5-5-7
6	-				Recovery: 4.0-6.0' = 100%
7	SSI			Clay, high plasticity; sl. sandy, fine grained, stiff to med. stiff, moist, dark brown to black (5.0-6.0), w. gray to gray (6.0-8.0) with scattered gravel up to cobble size 'CH'	SS = 8-10-15-28 Recovery: 6.0-8.0' = 100%
8					
9					
10					

WELL/PIEZOMETER COMPLETION DIAGRAM

Project Prospector Searc  
 Location Park City, UT  
 Geologist M. Faccani  
 Depth to Water 33.25 feet (G.L.)

TOD No. F08 - 2611-34 DWell Number PS - Hill - 1 DDate(s) of Installation 8-1-87Elevation from Measuring Point 6791.87

## DRILLING SUMMARY:

Driller E.D. G.G. - Alton ShowmakerRig Type CFK 31Drilling Method H & GBit(s) TAKE 7" PCDrilling Fluid Surface Casing Hollow Stem/Drive Casing I.D. (in.) 4 1/2"Total Depth of Boring (ft.) 85.0Borehole Diameter (in.) 7 1/2

## WELL DESIGN:

Above	<u>at</u>	Below
Completion Grade	<u>at</u>	Grade
Basis: Geological Log	<u>✓</u>	Geophysical Log
Total Depth of Well (ft.)	<u>80.3</u>	Type

Casing String(s):	C=casing	S=screen	
<u>C</u>	<u>80.3 - 80.0</u>	<u>S</u>	<u>80.0 - 70.0</u>
	<u>70.0</u>	<u>0</u>	<u>-</u>

Casing: 2 1/2" PVC schedule 80Screen: 2 1/2" stainless 20 DTD 50/5

Centralizers	<u>none</u>
Gravel/Sand Pack	<u>70.0</u> to <u>62.0</u> <u>feet</u>
Bentonite Seal(s)	<u>80.5</u> to <u>70.0</u> <u>feet</u>
Bentonite (type)	<u>100% bentonite</u>
Backfill (cuttings)	<u>to</u>
Cement Seal(s)	<u>62.0</u> to <u>18</u> <u>feet</u>
	<u>14.5</u> to <u>0</u> <u>feet</u>

Cement Composition:	<u>[% bentonite/bentonite] + 30% sand/10% cement</u>
Protective Casing	<u>30.0</u> to <u>0</u> <u>feet</u>
Protective Casing Type	<u>6" steel with locking top</u>

Other 

## WELL DEVELOPMENT:

Method BoilerDuration 1.5 hrs Estimated production 1.5 gpmWater Appearance slightly milky

## Remarks:

Bedrock at 83.0 ft / wood side 200 ft

WELL/PIEZOMETER COMPLETION DIAGRAM

Project Project for S Pacific  
 Location Dakota City, UT  
 Geologist R. T. Johnson  
 Depth to Water 33.25 feet (G.L.)

TDD No. F08 - 5511 - 34DWell Number DE - 11N - 15Date(s) of Installation 7-15-87Elevation from Measuring Point 5791.87

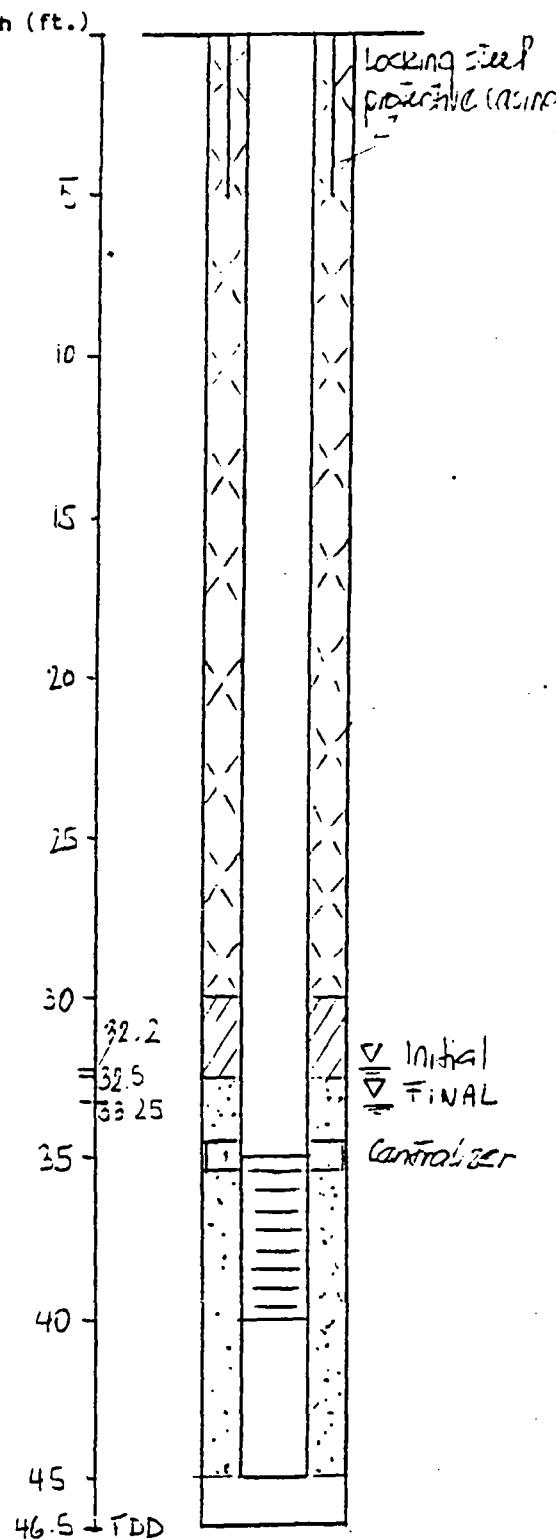
## DRILLING SUMMARY:

Driller Earth D.A.G. - Alton Schomaker

Rig Type CME 75  
 Drilling Method HOLLOW STEM LUGER  
 Bit(s) TDI 2 TYPE 1  
 Drilling Fluid NONE

Surface Casing  
 Hollow Stem/Drive Casing I.D. (in.) 4 1/4  
 Total Depth of Boring (ft.) 465  
 Borehole Diameter (in.) 7 3/4

## WELL DESIGN:



Above  
 Completion Grade / Below  
 Basis: Geological Log / Geophysical Log /  
 Type /

Total Depth of Well (ft.) 45  
 Casing String(s): C=casing S=screen  

$$\begin{array}{c|c|c|c} C & 45 & 40' & S \\ \hline & 145 & 7' & 35 \\ \hline & & & 47' \end{array}$$

Casing: 2" Schedule 60 PVC 113' SectionsScreens: 2" 1/4" 20 - 1/2" 0.020 - 100%

Centralizers 1" 35'  
 Gravel/Sand Pack 45 to 32.5 feet  
10-20 Mesh (coarse) 32.5 - 30 feet

Bentonite Seal(s) 32.5 to 30 feet  
to feet

Bentonite (type) 1/4" PVC  
 Backfill (cuttings) to feet

Cement Seal(s) 30.0 to 0 feet  
to feet

Cement Composition Portland 140# / 37.5#  
lime 140# 5.5% water

Protective Casing 1.5 to 0 feet

Protective Casing Type Steel w/ locking caps

Other \_\_\_\_\_

## WELL DEVELOPMENT:

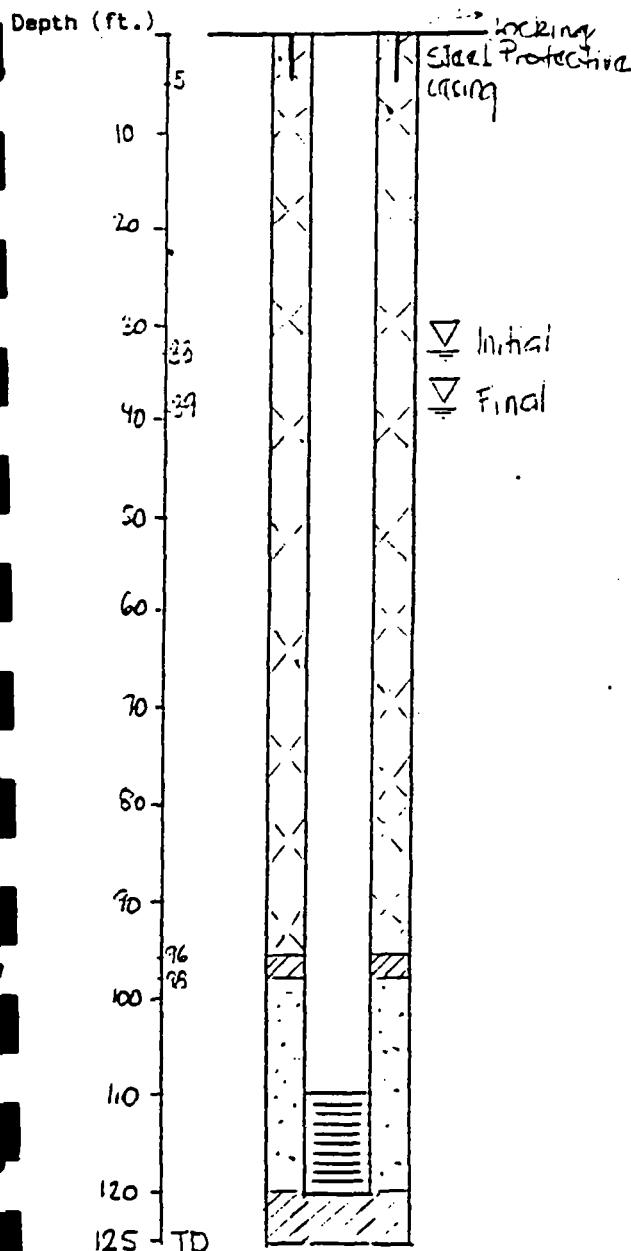
Method Hand pumpDuration 1 hrs Estimated production 100 gpmWater Appearance light murky 15 ft

Remarks: \_\_\_\_\_

WELL/PIEZOMETER COMPLETION DIAGRAM

Project Proector Square  
 Location Drik City, UT  
 Geologist M. P. Deeney  
 Depth to Water 39 ft feet (G.L.)

TOD No. F08 - 8611-341  
 Well Number PS-MW-20  
 Date(s) of Installation 8/20-21/87  
 Elevation from Measuring Point \_\_\_\_\_



DRILLING SUMMARY:

Driller Earth Ag. Data Group (Fox & Ass.)  
ATLON DRILLMAKERS  
 Rig Type CIMC 75  
 Drilling Method HSA, AIR ROTARY  
 Bit(s) TOOTH-TYPE, TRICONE TYPE  
 Drilling Fluid NONE

Surface Casing \_\_\_\_\_  
 Hollow Stem/Drive Casing I.D. (in.) 4 1/4" / 6 5/8"  
 Total Depth of Boring (ft.) 125  
 Borehole Diameter (in.) 8"

WELL DESIGN:

Completion Grade	Below Grade
Basis: Geological Log <input checked="" type="checkbox"/>	Geophysical Log _____
Total Depth of Well (ft.) <u>120.4</u>	Type _____
Casing String(s): C=casing S=screen	
<u>C 120.4 - 120</u>	<u>S 120 - 110</u>
<u>110 - 0</u>	<u>-</u>
Casing: PVC 2", Schedule 80, 10' sections	
Screen: PVC 2", Schedule 80, .010 slots	
Centralizers <u>NONE</u>	
Gravel/Sand Pack <u>i20</u>	to <u>98</u> feet
Colorado River Sand 10-20 Mesh	
Bentonite Seal(s) <u>0</u>	to <u>96</u> feet
<u>120</u>	<u>to 125</u> feet
Bentonite (type) <u>1/4" BENTONITE BEADS</u>	
Backfill (cuttings) <u>NA</u>	to _____ feet
Cement Seal(s) <u>0</u>	to <u>96</u> feet
Cement Composition <u>PORTLAND CEMENT (40X)</u>	
Slurry	
Protective Casing <u>0</u>	to <u>5</u> feet
Protective Casing Type <u>Steel</u>	<u>6 5/8"</u>
Other _____	

WELL DEVELOPMENT:

Method Hand Pump - Air Lift

Duration 2 hrs Estimated production 1.5 gpm

Water Appearance Sign. muddy

Remarks: water saturated with mineralized material  
dilution from 110-120' deep zone with an initial  
0.8-0.7 gpm

WELL/PIEZOMETER COMPLETION DIAGRAM

Project Proctor 90110

TDD No. FDE - 361 - 243

Location Dixie Rd. UT

Well Number 25-111-2

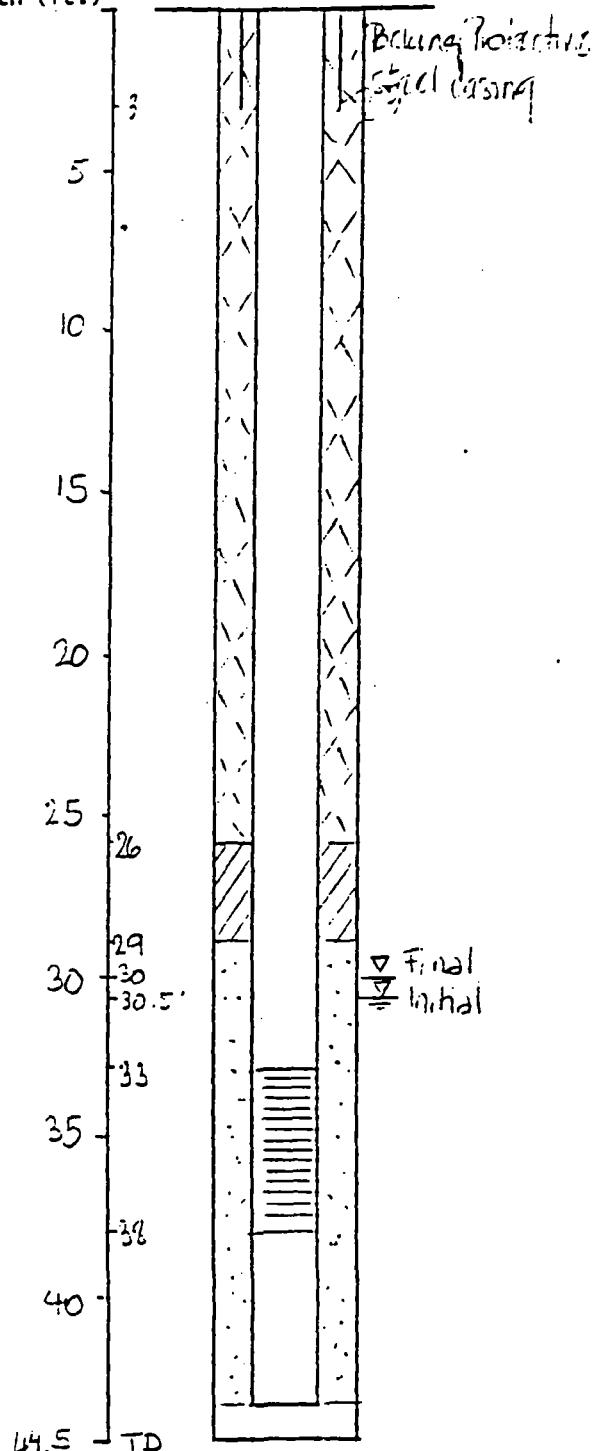
Geologist J. H. C.

Date(s) of Installation 7-16-87 / 7-17-87

Depth to Water 80.0 feet (G.L.)

Elevation from Measuring Point 6758.44

Depth (ft.)



**DRILLING SUMMARY:**

Driller Earl D. A. S. - Alton Schomann

Rig Type CME 75

Drilling Method DOWN HOLE AUGER

Bit(s) TOP - 2 ft. o.d.

Drilling Fluid 3 GALLONS LEST MARILINER

Surface Casing \_\_\_\_\_

Hollow Stem/Drive Casing I.D. (in.) ---

Total Depth of Boring (ft.) 243

Borehole Diameter (in.) 7.75

**WELL DESIGN:**

Completion Grade	<u>Above TL</u>	Grade	<u>Below</u>
Basis: Geological Log	<u>/</u>	Geophysical Log	<u>/</u>
Total Depth of Well (ft.)	<u>43.5</u>	Type	

Casing String(s): C=casing S=screen

C	<u>-43.5</u>	<u>-38</u>	<u>-33</u>
	<u>-32</u>	<u>0</u>	<u>0</u>

Casing: 2" Schedule 40 PVC      10' section 33-0  
5' section 14-55

Screen: 2" outside 7/8" I.D. 0.20" slots, 3 section

Centralizers None

Gravel/Sand Pack 43.5 to 20 feet  
10-14" ILSA OILITE SLICE SAND

Bentonite Seal(s) 29 to 26 feet  
to feet

Bentonite (type) 14" PEGASIS

Backfill (cuttings) to feet

Cement Seal(s) 26 to 0 feet  
to feet

Cement Composition 40% BENTONITE + 60% PORTLAND CEMENT

Protective Casing 1" 0.0 to 0.0 feet

Protective Casing Type Steel w. or cockrocks

Other None

**WELL DEVELOPMENT:**

Method Hand Pump

Duration 2 hrs Estimated production 0.5 gpm

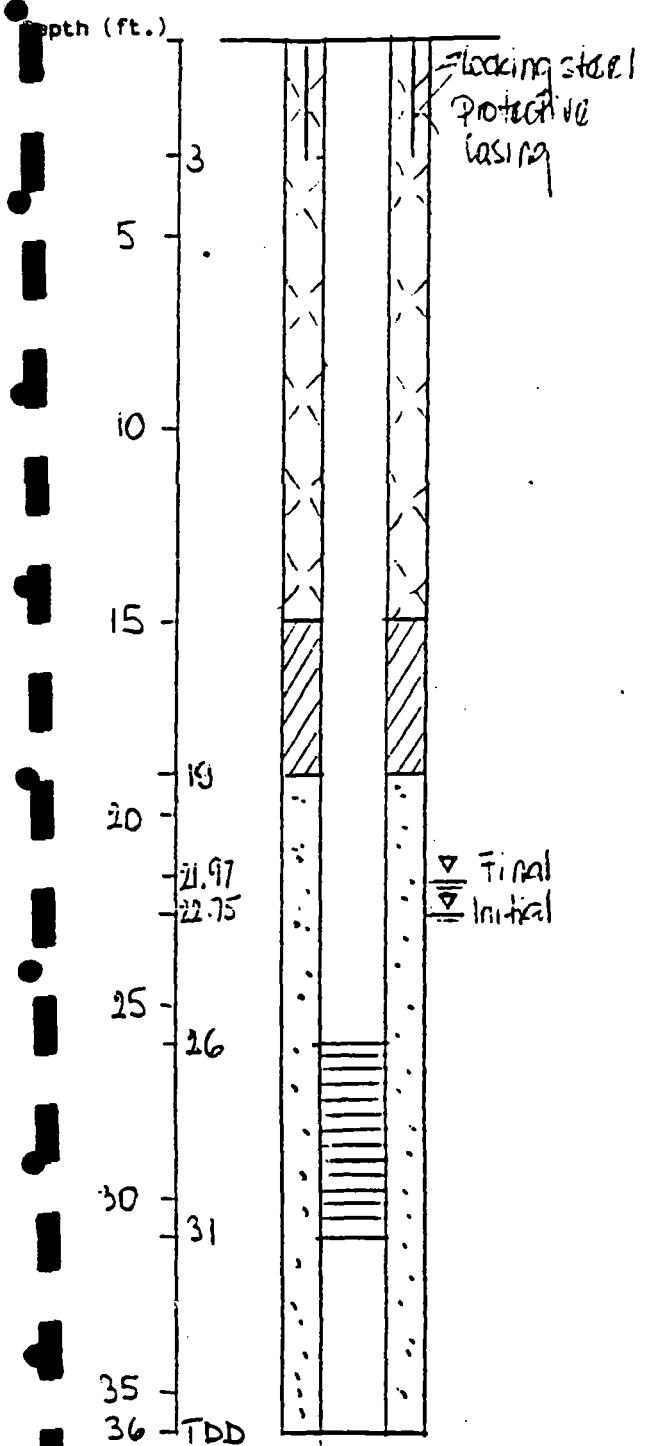
Water Appearance Clear

Remarks: \_\_\_\_\_

WELL/PIEZOMETER COMPLETION DIAGRAM

Project Promontory Section  
 Location Dixie City, UT  
 Geologist K. Moll  
 Depth to Water 21.97 feet (G.L.)

TDD No. F08-3611-34D  
 Well Number PS-11V-3  
 Date(s) of Installation 7-28/29-87  
 Elevation from Measuring Point 6743.35



**DRILLING SUMMARY:**

Driller S.D.G.G. Alton Schoemaker

Rig Type CFT-35  
 Drilling Method rotary  
 Bit(s) 7 1/2" x 10 ft  
 Drilling Fluid 2 gal/gal water

Surface Casing  
 Hollow Stem/Drive Casing I.D. (in.) 7 1/2  
 Total Depth of Boring (ft.) 36.0  
 Borehole Diameter (in.) 7 1/2

**WELL DESIGN:**

Above	at	Below	Grade
Completion Grade			
Basis: Geological Log	<input checked="" type="checkbox"/>	Geophysical Log	
Total Depth of Well (ft.)	<u>36.0</u>		
Casing String(s):	C=casing	S=screen	
	<u>C - 36</u>	<u>S - 31</u>	<u>- 31 - 26</u>
	<u>- 26</u>	<u>0</u>	
Casing:	<u>2" Schedule 80, PVC 5x10' Sections</u>		
Screen:	<u>2" Schedule 80, PVC 5' Section Casing</u>		
Centralizers	<u>None</u>		
Gravel/Sand Pack	<u>36</u>	<u>to</u>	<u>19</u> feet
	<u>0-20 Mesh Gravel sand</u>		
Bentonite Seal(s)	<u>19</u>	<u>to</u>	<u>15</u> feet
Bentonite (type)	<u>1/4" EPS</u>		
Backfill (cuttings)	<u>to</u>	<u>to</u>	feet
Cement Seal(s)	<u>to</u>	<u>to</u>	feet
Cement Composition	<u>40% Barite (100-120)</u>		
	<u>40% Portland cement + water</u>		
Protective Casing	<u>3</u>	<u>" to "</u>	feet
Protective Casing Type	<u>6" Steel w. sp. locking tops</u>		
Other			

**WELL DEVELOPMENT:**

Method Hand Pump

Duration 1 hrs Estimated production 1.25 gpm  
 Water Appearance slightly muddy

Remarks: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

WELL/PIEZOMETER COMPLETION DIAGRAM

Project Providence Spring  
 Location Dixie City UT  
 Geologist V. MOH  
 Depth to Water 16.12 feet (G.L.)

TDD No. PS - 5611-34D  
 Well Number PS - MW - 5  
 Date(s) of Installation 7-20-87, 7-27-87  
 Elevation from Measuring Point 6741.04

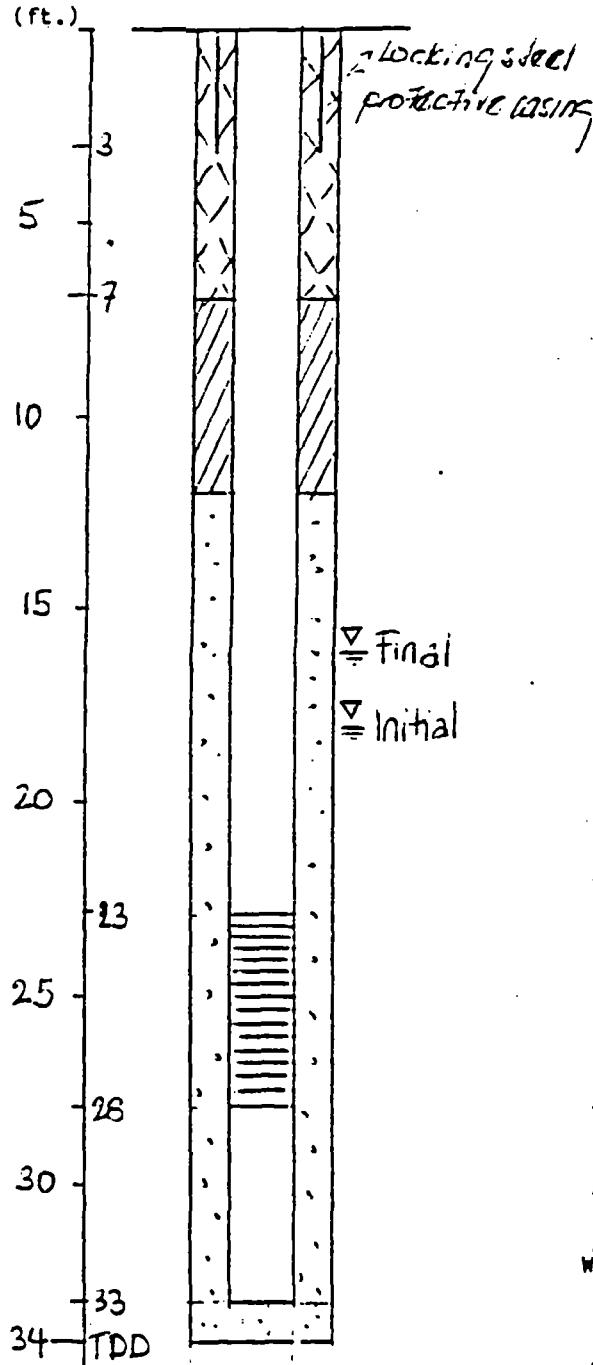
DRILLING SUMMARY:

Driller E. D. A. T. Alton Schoomaker

Rig Type CMC 75  
 Drilling Method HOLLOW STEM RIG  
 Bit(s) TOOK type "  
 Drilling Fluid "

Surface Casing  
 Hollow Stem/Drive Casing I.D. (in.) 4 1/2  
 Total Depth of Boring (ft.) 34.0  
 Borehole Diameter (in.) 7 1/2

WELL DESIGN:



Above	at	Below
Completion Grade		Grade
Basis: Geological Log	<input checked="" type="checkbox"/>	Geophysical Log
		Type
Total Depth of Well (ft.) <u>34.0</u>		
Casing String(s): C=casing S=screen		
<u>C</u>	<u>-33 -28</u>	<u>S</u> <u>5</u> <u>-28 -23</u>
<u>C</u>	<u>-23 -0</u>	<u>-</u>
Casing: <u>2" Schedule 80 PVC 5x10' sections</u>		
Screen: <u>2" Schedule 40 PVC .020 wall</u>		
<u>5' sections</u>		
Centralizers		
Gravel/Sand Pack	<u>23</u>	to <u>20</u> feet
<u>10-10 Mesh sand and sand</u>		
Bentonite Seal(s)	<u>12</u>	to <u>7</u> feet
<u>to</u>		
Bentonite (type)	<u>1/4" DEHETS</u>	
Backfill (cuttings)	<u>20</u>	to <u>7</u> feet
Cement Seal(s)	<u>7</u>	to <u>0</u> feet
<u>to</u>		
Cement Composition	<u>40% sand and 60% cement (thin slurry)</u>	
<u>- 70% cement 10% water - slurry</u>		
Protective Casing	<u>16.30</u>	to <u>0</u> feet
Protective Casing Type	<u>6" well w/ locking top</u>	
Other		

WELL DEVELOPMENT:

Method Hand pump

Duration 0.7 hrs Estimated production 2 gpm  
 Water Appearance

Remarks: Well was completed in a parallel water table.

WELL/PIEZOMETER COMPLETION DIAGRAM

Project Armenia for Square  
 Location Park City UT  
 Geologist K. Moll  
 Depth to Water 27.79 feet (G.L.)

TOD No. F08-8611-34D  
 Well Number 35-1MW-4  
 Date(s) of Installation 7-20/21-87  
 Elevation from Measuring Point 6773.49

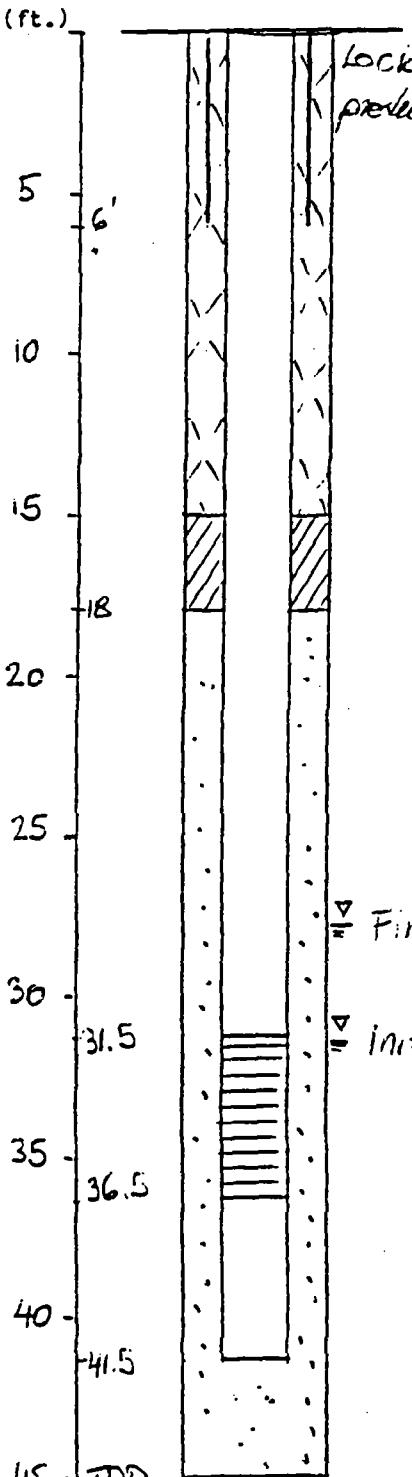
## DRILLING SUMMARY:

Driller E. D. A. G. Altan Slocemaker

Rig Type CME 13  
 Drilling Method FOLLOW STEM SURVEY  
 Bit(s) 100 FT SPOT  
 Drilling Fluid WATER

Surface Casing  
 Hollow Stem/Drive Casing I.D. (in.) 7.74  
 Total Depth of Boring (ft.) 45.0  
 Borehole Diameter (in.) 7.570

## WELL DESIGN:



Above	at	Below
Completion Grade		Grade
Basis: Geological Log	<input checked="" type="checkbox"/>	Geophysical Log
		Type
Total Depth of Well (ft.)	<u>45</u>	
Casing String(s): C=casing S=screen		
C - 45 - 40		S - 40 - 35
- 35 - 0		-
Casing: 2" Schedule 80 PVC 5' x 10' sections		
Screen: 2" Schedule 80 PVC .020 slots		
Centralizers	<u>None</u>	
Gravel/Sand Pack	<u>45</u>	feet
10-20 Mesh Silica - sand	to	18
Bentonite Seal(s)	<u>18</u>	feet
	to	
Bentonite (type)	<u>114" pellets</u>	
Backfill (cuttings)	to	
Cement Seal(s)	<u>15</u>	feet
	to	
Cement Composition	<u>4% Calcium + 10% Portland 1/1</u>	
Protective Casing	<u>6'</u>	feet
Protective Casing Type	<u>5" steel with locking cap</u>	
Other	<u>0</u>	

## WELL DEVELOPMENT:

Method Hand pump + bailer

Duration 0.15 hrs Estimated production 1.5 gpm  
 Water Appearance

Remarks: well was filter packed after completion  
 1. Every blow was used fresh bailed to clean the well  
 2. During completion well was clogged up to 41.5'  
 Adjust drilling summary data to 25 ft.

WELL/PIEZOMETER COMPLETION DIAGRAM

Project Prospector Seawall  
 Location Park. City, UT  
 Geologist R. Moll  
 Depth to Water 13.0 feet (G.L.)

TDD No. F98 - 8611-341  
 Well Number PS-MW-6  
 Date(s) of Installation 7-20/21-87  
 Elevation from Measuring Point 6731.48

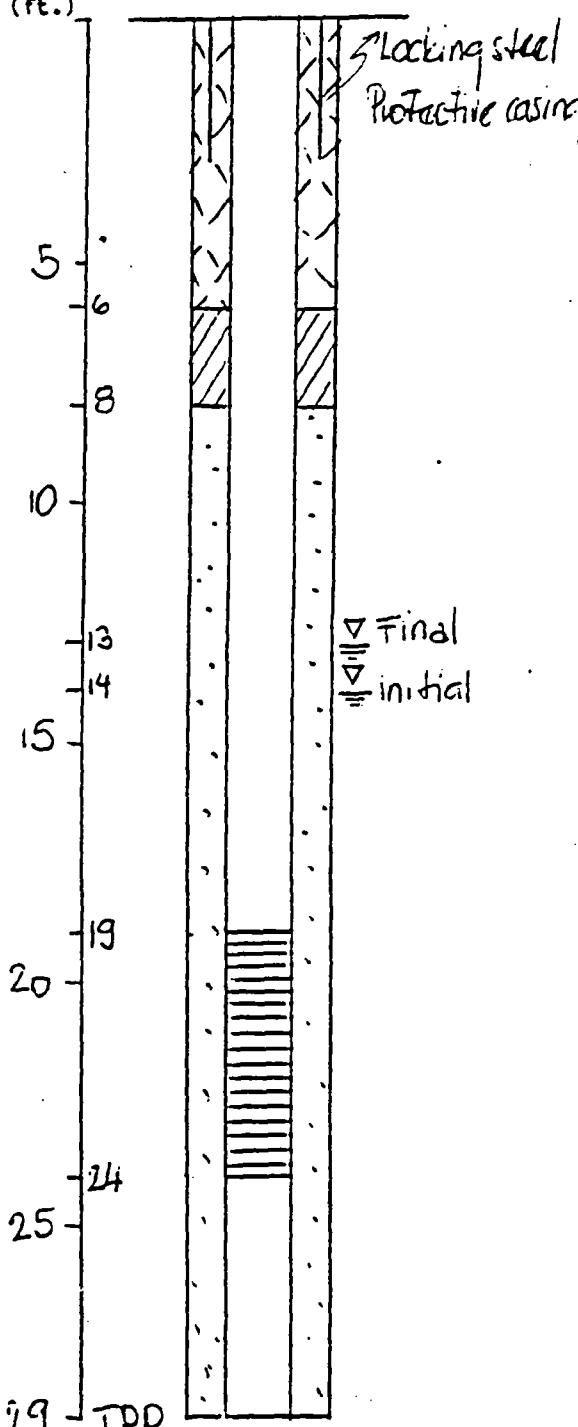
DRILLING SUMMARY:

Driller E.A.D. J. - Alton Schoonmaker

Rig Type CPIE 70  
 Drilling Method HOLLOW STEM TURF  
 Bit(s) 10" x 10' TURF  
 Drilling Fluid 0.011 DISCHILLED WATER

Surface Casing  
 Hollow Stem/Drive Casing I.D. (in.) 7.77  
 Total Depth of Boring (ft.) 29.  
 Borehole Diameter (in.) 11.6

WELL DESIGN:



Above  
 Completion Grade at Below  
 Basis: Geological Log ✓ Geophysical Log \_\_\_\_\_  
 Type \_\_\_\_\_

Total Depth of Well (ft.) 29.0  
 Casing String(s): C=casing S=screen  
C - 29 - 29 | S - 24 - 19  
- 19 - 0 | -

Casing: 2" Schedule 80 PVC  
 Screen: 2" Schedule 80 PVC .005 slot

Centralizers none  
 Gravel/Sand Pack 29 to 30 feet  
10-10 MLC is 10 sand  
 Bentonite Seal(s) 29 to 30 feet  
 Bentonite (type) 114° FELLET  
 Backfill (cuttings) 29 to 30 feet  
 Cement Seal(s) 29 to 30 feet  
 Cement Composition Portland Type II cement

Protective Casing 3.0 to 0 feet  
 Protective Casing Type 6" Steel w/ large caps

Other \_\_\_\_\_

WELL DEVELOPMENT:

Method Hyd. Pump

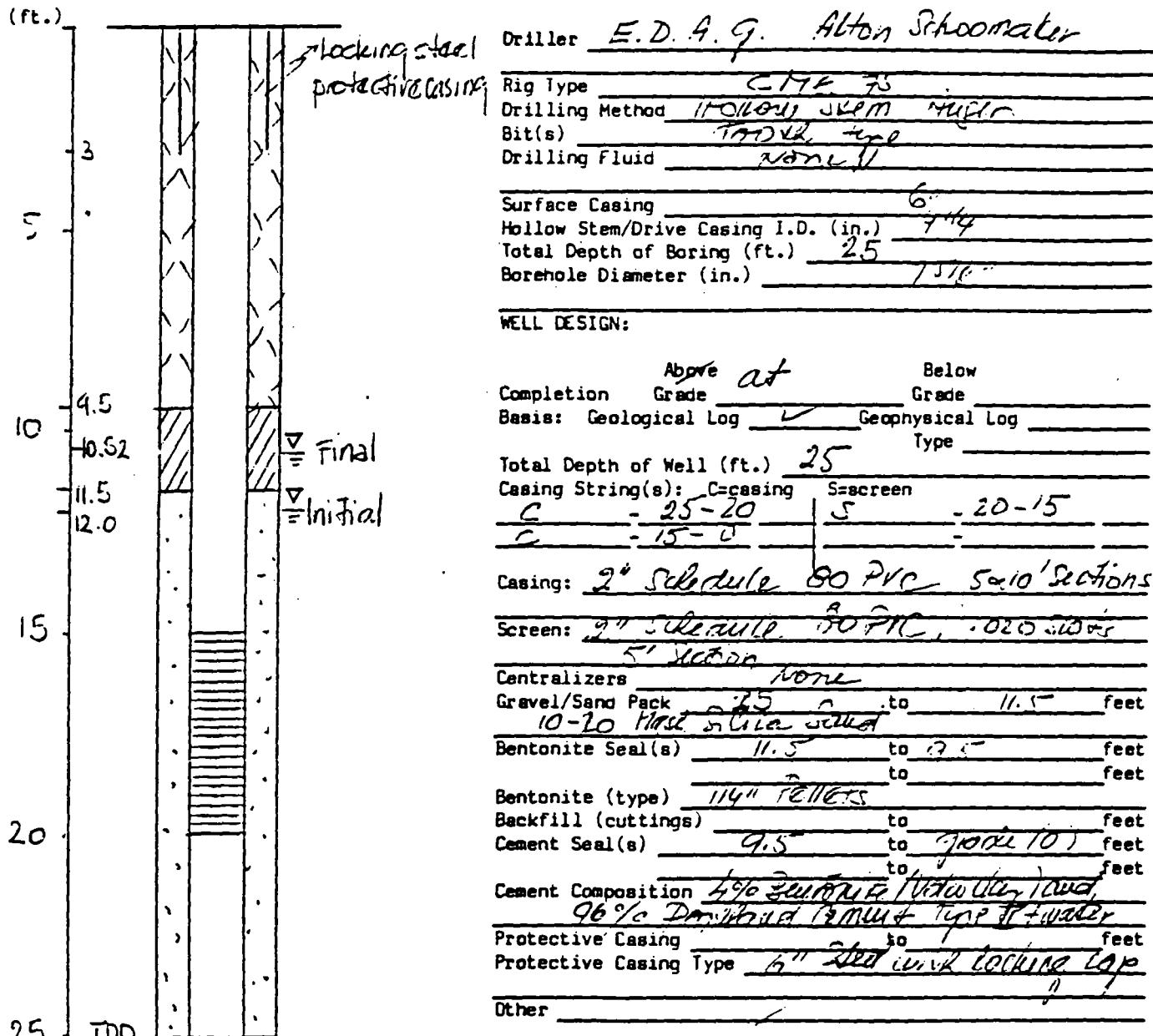
Duration 0.9 hrs Estimated production 1 gpm  
 Water Appearance clear

Remarks: Some wash cuttings are mixed with sand pack at 14-8' interval

WELL/PIEZOMETER COMPLETION DIAGRAM

Project Prospector Square  
 Location Dixie City UT  
 Geologist K. Moll  
 Depth to Water 10.52 feet (G.L.)

TDD No. F03 - 8611 - 34D  
 Well Number PS - HW - 7  
 Date(s) of Installation 7-24-87  
 Elevation from Measuring Point 6722.46



WELL DEVELOPMENT:

Method Hand Pump  
 Duration 0.75 hrs Estimated production 0.6 gpm  
 Water Appearance muddy  
 Remarks: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

WELL/PIEZOMETER COMPLETION DIAGRAM

Project Providence Spring

Location Dish Pit, VT

Geologist Hile Peccary

Depth to Water \_\_\_\_\_ feet (G.L.)

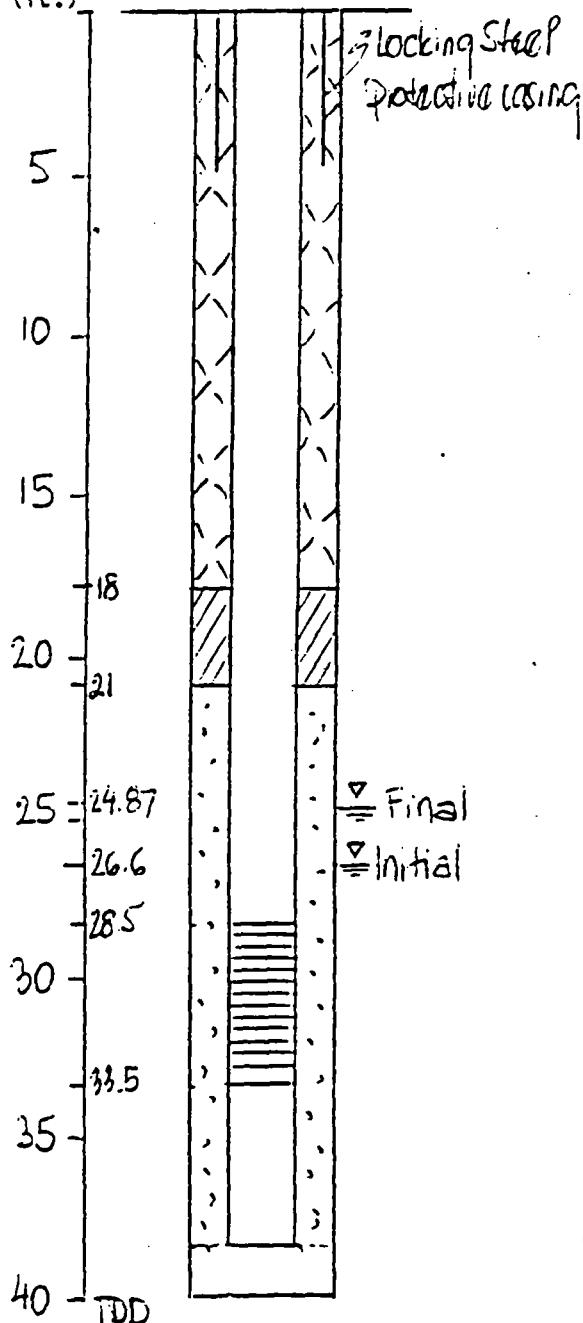
TDD No. F78-8611-34D

Well Number PS-MW-8

Date(s) of Installation 8/4/87

Elevation from Measuring Point 6751.41

Depth (ft.)



**DRILLING SUMMARY:**

Driller E. D. A. G. Alton Schoomaker

Rig Type CITY = 73  
Drilling Method HOLLOW STEM RIGGER  
Bit(s) TDOL 4 1/2"  
Drilling Fluid /

Surface Casing \_\_\_\_\_  
Hollow Stem/Drive Casing I.D. (in.) 4 7/8  
Total Depth of Boring (ft.) 20.0  
Borehole Diameter (in.) 7 1/8

**WELL DESIGN:**

Completion	Grade	Grade
Basis: Geological Log	/	Geophysical Log
		Type

Total Depth of Well (ft.) 31.5  
Casing String(s): C=casing S=screen  

C - 24.5 - 33.5	S - 33.5 - 18.5
- 28.5 0	-

Casing: 2" Schedule 80 PVC, 5x10' Sections

Screen: 2" Intraule PVC 0.020 slots

Centralizers NONE  
Gravel/Sand Pack 39. to 21 feet  
10-20 Mesh Gravel Sand  
Bentonite Seal(s) 21 to 18 feet  
to feet  
Bentonite (type) 114 Pounds  
Backfill (cuttings) to feet  
Cement Seal(s) 18 to 0 feet  
to feet  
Cement Composition 100 BENTONITE + 10,000 LB TYPE II  
Protective Casing 5 to 0 feet  
Protective Casing Type 6" steel w/locking cap

**WELL DEVELOPMENT:**

Method \_\_\_\_\_

Duration \_\_\_\_\_ hrs Estimated production \_\_\_\_\_ gpm  
Water Appearance \_\_\_\_\_

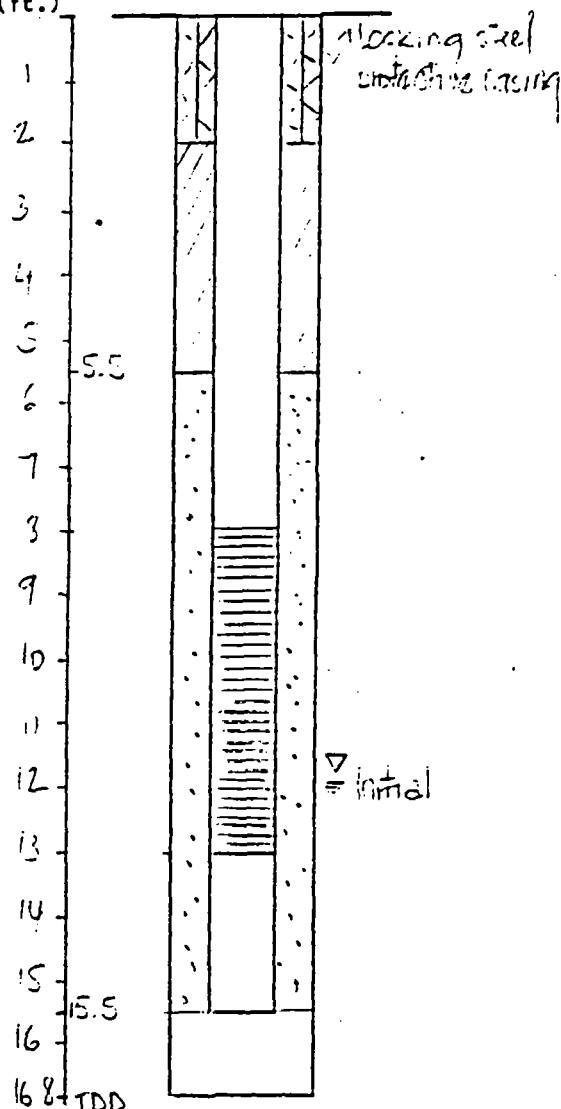
Remarks: Obtained hole 100-8 was drilled at the  
same intaking screen, wrong completion  
(unscrewing PVC casing by HSA) !

### WELL/PIEZOMETER COMPLETION DIAGRAM

Project Location Survey  
 Location Paris, IL  
 Geologist J. H. C. H.  
 Depth to Water 6.0 feet (G.L.)

TDD No. F-18 - 3644 - 24  
 Well Number 45-1111-7  
 Date(s) of Installation 7-22-77  
 Elevation from Measuring Point 620±7

Depth (ft.)



#### DRILLING SUMMARY:

Driller E.D.-S. 45m. Diamond

Rig Type 12-21

Drilling Method rotary

Bit(s) 7-1/2" DIA

Drilling Fluid Water

Surface Casing

Hollow Stem/Drive Casing I.D. (in.) 4-1/2

Total Depth of Boring (ft.) 15.5

Borehole Diameter (in.) 7-1/2

#### WELL DESIGN:

Above	<u>15</u>	Below
Completion Grade		Grade

Basis: Geological Log	<u>/</u>	Geophysical Log
-----------------------	----------	-----------------

Type

Total Depth of Well (ft.) 15.5

Casing String(s): C=casing S=screen

<u>C</u>	<u>-15-13</u>	<u>S</u>	<u>-13-8</u>
<u>-8-0</u>			

Casing: 2" Schedule 50 PVC, 10' sections

Screen: 2" diameter 10' long, 600 slots

Centralizers none

Gravel/Sand Pack 15-13 to 5.5 feet  
10-12' long

Bentonite Seal(s) 5.5 to 2.0 feet

to 0.0 feet

Bentonite (type) 16" bentonite

Backfill (cuttings) to feet

Cement Seal(s) -0 to 0.0 feet

to 0.0 feet

Cement Composition Portland cement

Protective Casing 2.0 to 0.0 feet

Protective Casing Type Steel pipe

Other None

#### WELL DEVELOPMENT:

Method hand pump & Bailer

Duration 1.5 hrs Estimated production 1 gpm

Water Appearance clear

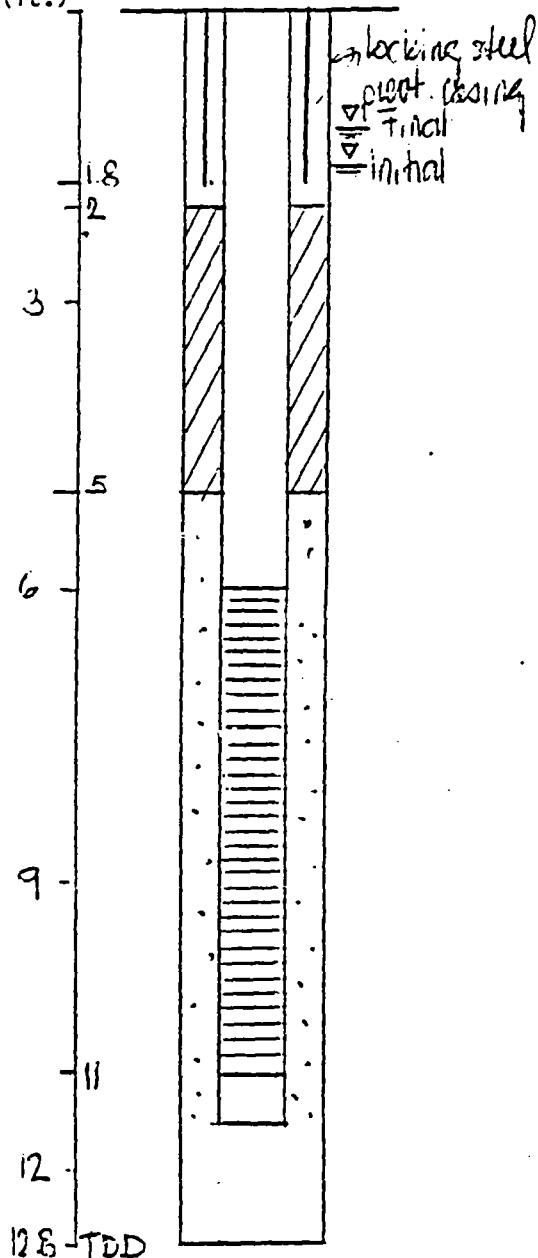
Remarks: Exhaust at 15.0' resulting in

WELL/PIEZOMETER COMPLETION DIAGRAM

Project Proprietor Square  
 Location Disk Cut 07  
 Geologist H. F. Clegg  
 Depth to Water 10.24 feet (G.L.)

TDD No. FOS - 3611 - 34D  
 Well Number PS - MW - 10  
 Date(s) of Installation 7-31-87  
 Elevation from Measuring Point \_\_\_\_\_

Depth (ft.)



DRILLING SUMMARY:

Driller E. D. A. G. ALTON SCHOONAKER

Rig Type CME 73  
 Drilling Method HOLLOW STEM AIR  
 Bit(s) TOOT type  
 Drilling Fluid oil

Surface Casing \_\_\_\_\_  
 Hollow Stem/Drive Casing I.D. (in.) 4 1/2"  
 Total Depth of Boring (ft.) 12.8'  
 Borehole Diameter (in.) 7 1/8"

WELL DESIGN:

Completion Grade	<u>Above</u>	Grade	<u>at</u>	Grade
Basis: Geological Log	<input checked="" type="checkbox"/>	Geophysical Log		Type

Total Depth of Well (ft.) 11.5  
 Casing String(s): C=casing S=screen  
C - 11.5 - 11.0      S - 11.0 - 6.0  
- 6.0 - 0      -

Casing: 2" Schedule 80, PVC  
 Screen: or sleeve 50 PVC 0.0205 slot

Centralizers None  
 Gravel/Sand Pack 10-20 Mesh silica sand to 3.0 feet  
 Bentonite Seal(s) 1.0 to 2.0 feet  
 Bentonite (type) 11% water  
 Backfill (cuttings) to feet  
 Cement Seal(s) 2.0 to 0 feet  
 Cement Composition 3:1 MORTAR + 1:1 CEMENT & WATER  
 Protective Casing 18" to 0 feet  
 Protective Casing Type 6" Steel w/ plastic cap  
 Other \_\_\_\_\_

WELL DEVELOPMENT:

Method \_\_\_\_\_

Duration 1 hrs Estimated production 0.8 gpm  
 Water Appearance muddy

Remarks: \_\_\_\_\_

WELL/PIEZOMETER COMPLETION DIAGRAM

Project Provo City Sewer  
 Location Pink City, UT  
 Geologist H. Penning  
 Depth to Water 1.85 feet (G.L.)

TDD No. F08-2611-340  
 Well Number DC-HW-11  
 Date(s) of Installation 8-13-67  
 Elevation from Measuring Point \_\_\_\_\_

**DRILLING SUMMARY:**

Driller E. D. A. G. Alton Schoomaker

Rig Type CHF-70

Drilling Method US 3

Bit(s) TANDEM - 10"

Drilling Fluid WATER

**Surface Casing**

Hollow Stem/Drive Casing I.D. (in.) 4 1/4

Total Depth of Boring (ft.) 23.0

Borehole Diameter (in.) 7 5/8

**WELL DESIGN:**

Completion Grade	<u>at</u>	Below Grade
<input checked="" type="checkbox"/> Geological Log		<input type="checkbox"/> Geophysical Log
Type _____		

Total Depth of Well (ft.) 20.0

Casing String(s): C=casing S=screen

<u>- 20 - 15</u>	<u>- 5</u>	<u>- 15 - 10</u>
<u>- 10 - 0</u>	<u>-</u>	<u>-</u>

Casing: 2" Schedule 80 PVC

Screen: 2" Schedule 80 PVC 0.020 slot

Centralizers None

Gravel/Sand Pack 10 - 20 Mesh Silica Sand to 3.5 feet

Bentonite Seal(s) 2.1 to 1.5 feet

Bentonite (type) 1/4" FIBER

Backfill (cuttings) to feet

Cement Seal(s) 1.5 to 0 feet

Cement Composition Portland type II cement

Protective Casing 1.0 to 0 feet

Protective Casing Type 6" Steel w/ locking cap

Other \_\_\_\_\_

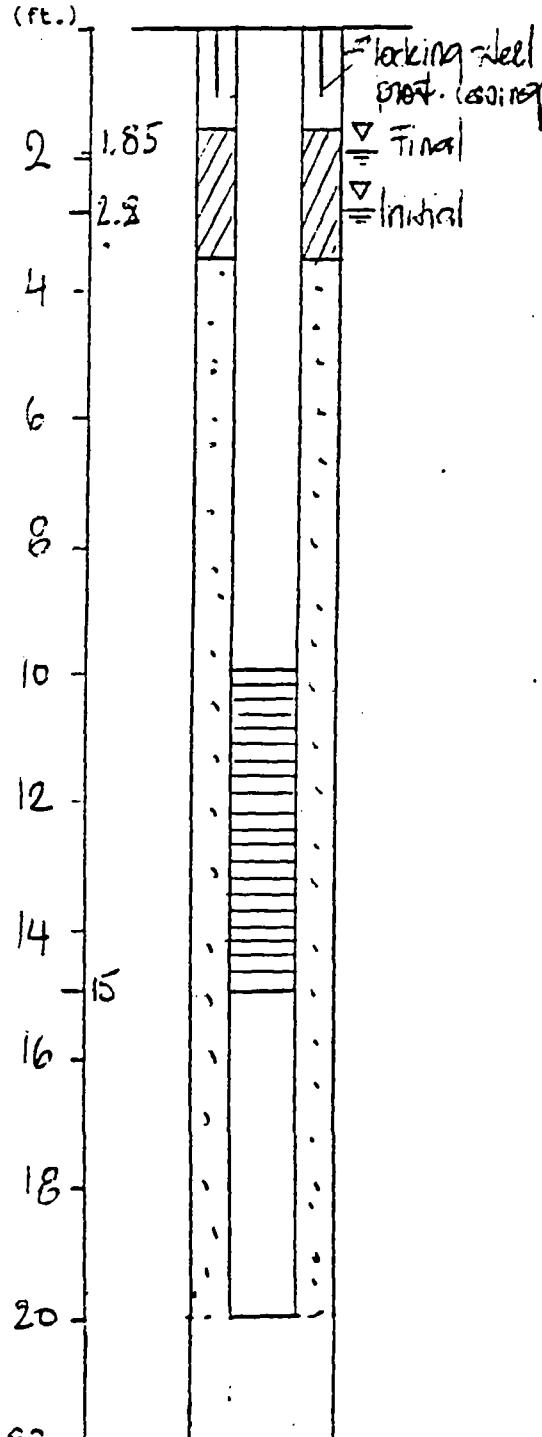
**WELL DEVELOPMENT:**

Method Hand pump

Duration 50 min hrs Estimated production 1.2 gpm

Water Appearance Slight muddy

Remarks: \_\_\_\_\_



TDD 220

# ecology and environment, inc.

1776 SOUTH JACKSON STREET, DENVER, COLORADO 80210, TEL. 303-757-4984

International Specialists in the Environment

TO : Paula Schmittiel, EPA Utah State Coordinator  
FROM : Mike Carmien, E & E FIT  
DATE : March 15, 1988  
SUBJECT: Draft Report, Field Activities, Well Drilling, Prospector Square, Park City, Utah, TDD F08-8611-34J.

The purpose of this report is to briefly summarize the drilling activities at Prospector Square, Park City, Utah in fulfillment of TDD F08-8611-34J. Five new monitoring wells were installed throughout Prospector Square by E & E FIT, with project officer Ken Moll. These wells are to be used by the USGS for aquifer tests and ground water sampling. Scheduled events are: well installation, January - February, 1988; aquifer pump testing, February, 1988; and ground water sampling, March, 1988.

The objectives of the five monitoring wells were to provide data needed to determine if pumping of the Park Meadows Well affects water levels in the unconsolidated valley fill overlying the Thaynes Formation in areas adjacent to the Silver Creek Tailings Site. These wells were also used to determine if the valley fill at the Silver Creek Tailings site contains any layers of low permeable strata that would retard ground water flow towards the Thaynes aquifer.

The contractor used for the drilling and installation of these wells was Dave's Drilling out of Salt Lake City, Utah. Two different rig types were used, the first being a Chicago Pneumatic 7000 air rotary drill with hammer and casing; the second, a Portadrill Model TLT hollow stem auger rig. Several contract disputes arose over performance and sampling costs, with a final agreement of delay time payment minus the first half hour for each sample taken. With contract disputes settled, well installation work continued on without incident.

Five new monitoring wells were installed into the unconsolidated valley fill at and around Prospector Square, Park City, Utah. These wells were numbered PS-MW-13, PS-MW-14, PS-MW-11D, PS-MW-7D and PS-MW-5D. Figure 1 of this draft report illustrates the locations of these wells. Ecology and Environment, Inc. personnel worked closely with the USGS personnel in meeting the specifications of well lithology logging, bedrock confirmation, well installations and well development as specified in the contract. All wells were drilled to bedrock (Thaynes or Woodside Formations) and then the wells were set above the bedrock - valley fill interface

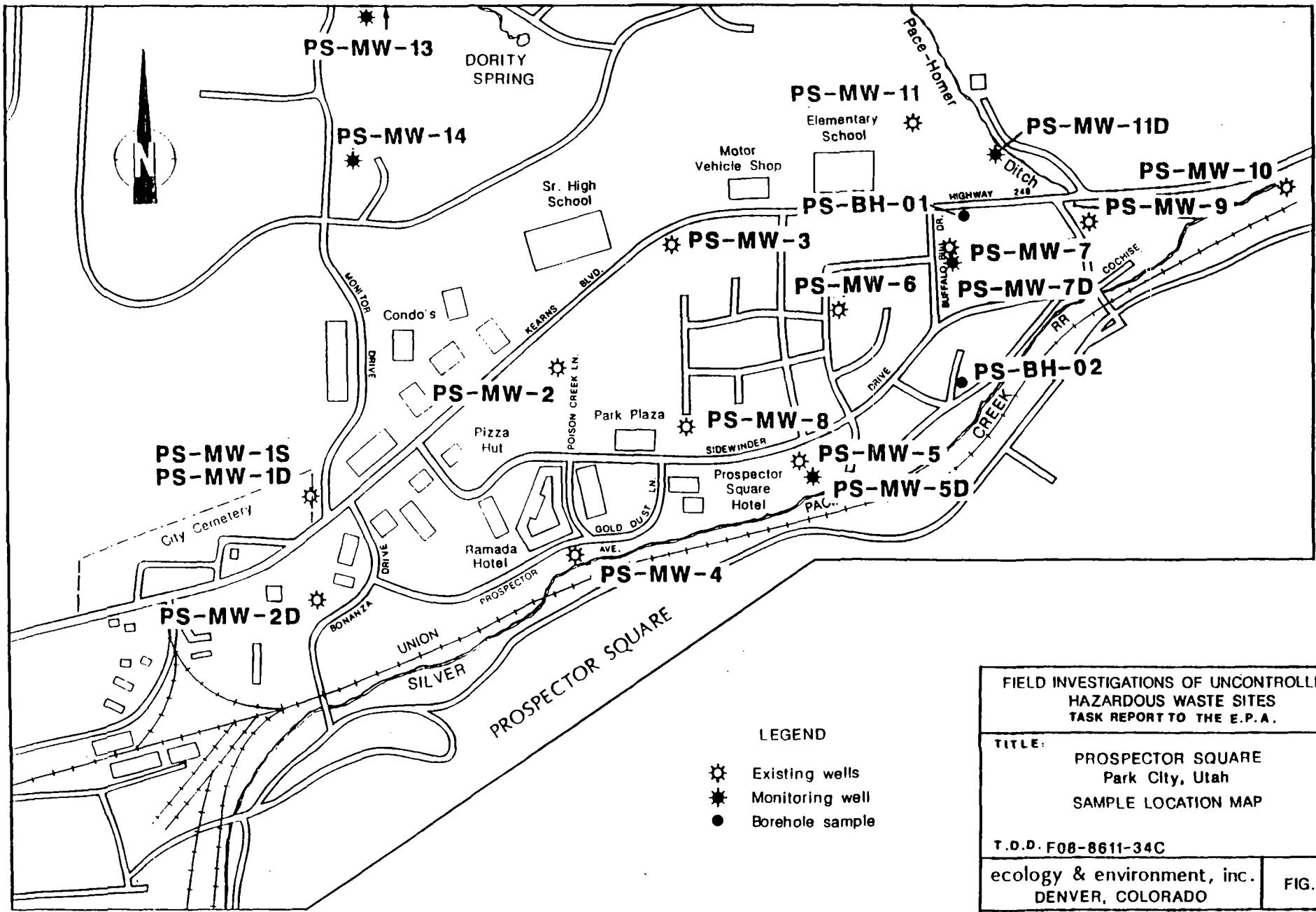
in the alluvium. All wells were then installed and developed according to contract specifications. Table 1 of this report lists the dates of drilling activities per well. This table also provides information on borehole depth, rig type, static water levels, depth of intake, etc.

Lithologic logging for all five wells was performed using 18 inch split spoon samplers. Samples were generally taken every 10 feet with the hollow stem auger rig, except when changes in lithology dictated a change in sampling depth. The Chicago Pneumatic Rig operated with 20 foot steel casings, which made sampling every 10 feet cumbersome and eventually a center of the contract disputes mentioned earlier. All samples were recorded in Field Log Books and pictures were taken by the USGS. For a more complete description of the individual well lithology, please see the attached lithologic logs.

Information regarding the lithology for well PS-MW-5D has been estimated for this report due to the unavailability of the field note book at the time this was written. A more complete lithology for PS-MW-5D will be updated into the Prospector Square's file when this information becomes available.

TABLE 1  
 WELL CHRONOLOGY AND SPECIFICATIONS  
 PROSPECTOR SQUARE, PARK CITY, UTAH  
 TDD F08-8611-34J

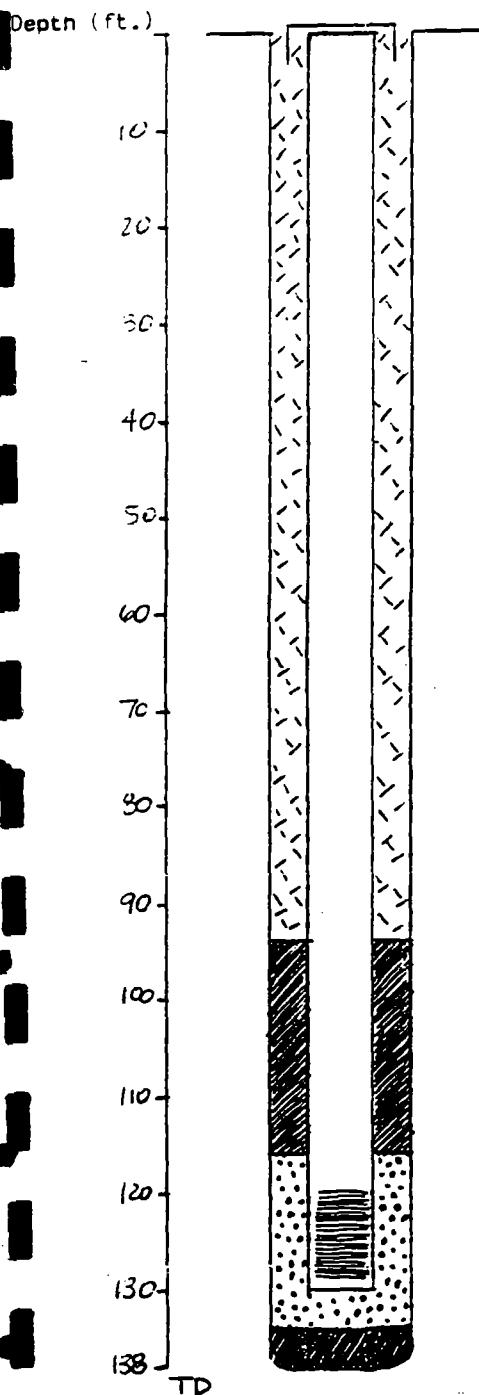
WELL NO.	DATES OF DRILLING	DATES OF INSTALLATION 1988	BORE HOLE DEPTH	STATIC WATER LEVEL	DEPTH OF SCREEN	LOGGING METHOD	RIG TYPE
PS-MW-13	1/21-1/23	1/23-1/24	61 ft	8.7 ft	51-41 ft	Split Spoon	Casing Hammer
PS-MW-14	1/24-1/26	1/26-1/27	75 ft	27 ft	58.5-48.5 ft	Split Spoon	Casing Hammer
PS-MW-11D	2/4-2/6	2/6-2/7	85 ft	15 ft	79.8-69.8 ft	Split Spoon	Hollow Stem Auger
PS-MW-7D	2/9-2/13	2/13-2/14	138 ft	12 ft	130-120 ft	Split Spoon	Hollow Stem Auger
PS-MW-5D	2/88-2/21	2/21-2/22	95 ft	20 ft	93-83 ft	Split Spoon	Hollow Stem Auger



WELL/PIEZOMETER COMPLETION DIAGRAM

Project Prospector Square  
 Location Park City, Utah  
 Geologist Diane Coker  
 Depth to Water 20' initially;  
                   11' post construction;  
                   pre-development

TDD No. F08 - 4011 - 34  
 Well Number PS - MLW - 7D  
 Date(s) of Installation 2/14/88  
 Elevation from Measuring Point \_\_\_\_\_



DRILLING SUMMARY:

Driller Dave's Drilling  
 Salt Lake City, Utah  
 Rig Type Frontendrill CP 7000  
 Drilling Method hollow stem auger  
 Bit(s) tooth (G)  
 Drilling Fluid none used

Surface Casing 6" steel with locking steel cap  
 Hollow Stem/Drive Casing I.D. (in.) 4 1/4"  
 Total Depth of Boring (ft.) 138  
 Borehole Diameter (in.) 7 1/4

WELL DESIGN:

	Above Completion Grade	Below Grade
Basis:	Geological Log <input checked="" type="checkbox"/>	Geophysical Log <input type="checkbox"/>
Total Depth of Well (ft.)	130	
Casing String(s):	C=casing	S=screen
	130' - 120' S	-
	120' - +.50' C	-
Casing:	PVC, 2", sched 80, flush joint	
Screen:	PVC, 2" 20-slot	
Centralizers	none used	
Gravel/Sand Pack	134 to 116	feet
	10-20 mesh Colorado Silica Sand	
Bentonite Seal(s)	116 to 94	feet
	138 to 134	
Bentonite (type)	B8-134 Volclay 1/2" pellets; 116-94	
Backfill (cuttings)	- to -	feet
Cement Seal(s)	94 to 0	feet
Cement Composition	Portland Type II cement grout w/ 5% Quik Gel and 7 gal H2O per sack (94lb) cement	
Protective Casing	3.5 to +.5	feet
Protective Casing Type	6" steel w/locking steel cap	
Other	PVC slip cap on top of PVC casing; PVC screw cap on bottom of completion string	

WELL DEVELOPMENT:

Method Air lift

Duration 2 1/2 hrs Estimated production 1 1/2 gpm  
 Water Appearance \_\_\_\_\_

Remarks: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

10/04/86

LITHOLOGIC LOG  
PROSPECTOR SQUARE

Page 1 of 2

WELL BORING NO. PS-MW-7D

LOCATION Buffalo Bill/Doc Holliday

NE/NW/NW SEC 10, T 25, R 4 E

DRILLING CONTRACTOR Dave's Drilling

RIG TYPE Portacrill

LOGGER E/DC

ELEVATION (ft.s.l.)

BORING COMPLETION DATE 10/11/86

DRILLING METHOD hollow stem auger

WATER LEVEL 1st ENCOUNTERED (ft. BGS) 15.00

STATIC WATER LEVEL (ft. BGS) 13.00

(BGS = Below Ground Surface)

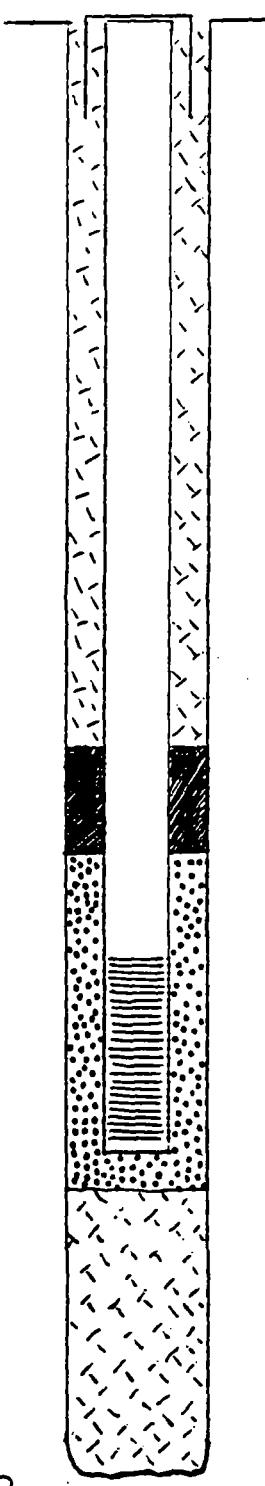
Depth in ft	Lithol. Column	Sample Type ID	LITHOLOGIC DESCRIPTION	COMMENTS
0			For description of samples from 0-25'. refer to Lithologic Log for Well PS-MW-7, located 5' north of PS-MW-7D	No split spoon samples obtained 0-29'
10				
20				
30	CORE	SAND, v f to f, v w srtd, ang to sbang, qtz, mica, biot, ls & rk chps; and GRAVEL, c, p srtd, w/10% sdy cly mtx	Spl son 30-31.5'; blw ct 15/43 (6'); 80% rcvy	
35	CORE	CLAY, r brn to gy, sft to hd, w/blk str of carb mat; and SAND, m to c, w srtd, sbang to rd, fldsp, qtz, rk chos	Spl son 35-36.5'; blw ct 72 ttl: 100% rcvy	
40	CORE	SAND, f to m, w srtd, sbang to ang, ss, ls, & sh chos, incr gr sz w/depth; and GRAVEL, sdy, cly (5-10%), p srtd, ang, ss, ls, sh chps	Spl son 40-41.5'; 100% rcvy	
45	CORE	CLAY, brn, w/sd, gyl, & cb1	Spl son 45-46.5'; blw ct 72/83/71 (6'); 90% rcvy	
50	CORE	CLAY/SAND/GRAVEL, cbls; p srtd, ang to sbang, cly abt 10%	Spl son 55-56.5'; 100% rcvy	
60	CORE	CLAY/SAND/GRAVEL, cbls, p srtd, w/r ctzt clasts	Spl son 65-66.5'; 100% rcvy	

70	CORE	CLAY/SAND/GRAVEL. colis. & srted. w/r silty ss. ss. & rk chas; cly act 10%	Sol son 73-75.5'; 100% revy; int 73-75.4' core "fill"
80	CORE	CLAY/SAND/GRAVEL. colis. r brn to y brn. cly also cx gn/brn & gy; o srted. sbang to sord; ss. ctzt. & rk chas	Sol son 83-85.5'; 100% revy
90	CORE	CLAY/SAND/GRAVEL. intbd & mxds; r brn; cly soy & hc; sd m to c; o srted. sbang to sord; gvi soy. cly. o srted	Sol son 93-95.5'; 100% revy
100	CORE	CLAY, gy w/r & y srt. hd. w/intbd sord ctzt. ss. & rk chas. some w/wthrd gn pink; also in cly. brn & blk card mat, incl roots	Sol son 100-101.5'; blw ct 35/35/32 (.5"); 100% revy
110	CORE	CLAY/SAND/GRAVEL. colis. r brn; cly sft; sd m to c; sd. gvi & colis o srted. sbang to sord; clasts fldso, ctz, ctzt, rx chas	Sol son 110-111.5'; blw ct 71/220/.__ (.5"); 100% revy
120	CORE	CLAY, brn w/r, y, & ox; m stiff; soy, silty	Sol son 120-121.5'; blw ct 12/10/25 (.5"); 100% revy
130	CORE	GRAVEL, fn obl. w srted, sbang to sord. fldsor, ctz; a few rk chas	Sol son 135-136.5'; 100% revy
	GRAB	TD - 138'	Refusal 138'

WELL/PIEZOMETER COMPLETION DIAGRAM

Project Prospector Square TDD No. F08 - 9611 - 34  
 Location Park City, Utah Well Number PS - MW - 14  
 Geologist Mike Carmien/Ken McII Date(s) of Installation 1/27/58  
 Depth to Water 27.7 feet (G.L.) Elevation from Measuring Point \_\_\_\_\_

Depth (ft.).



DRILLING SUMMARY:

Driller Dave's Drilling  
Salt Lake City, Utah  
 Rig Type Air rotary drill Chicago Pneumatic 7000  
 Drilling Method Air rotary casing drill + hammer  
 Bit(s) Tri cone 7 1/2" Utiamond stud  
 Drilling Fluid none used

Surface Casing 6" steel with locking cap

Hollow Stem/Drive Casing I.D. (in.) 7 7/8

Total Depth of Boring (ft.) 75

Borehole Diameter (in.) 7 1/2

WELL DESIGN:

Completion Grade At grade Below Grade \_\_\_\_\_  
 Basis: Geological Log  Geophysical Log \_\_\_\_\_  
 Total Depth of Well (ft.) 58.5 Type split spoon + cuttings samples  
 Casing String(s): C=casing S=screen  
58.5 - 48.5 S |  
48.5 - 0 C |  
 Casing: 2" PVC flush joint Sched 80  
 Screen: 2" PVC 20-slot (10-ft section)  
 Centralizers none used  
 Gravel/Sand Pack 60.5 to 43 feet  
Colorado Silica 10-20 mesh sand  
 Bentonite Seal(s) 43 to 37.5 feet  
 to feet  
 Bentonite (type) Baroid Quik-Gel  
 Backfill (cuttings) — to — feet  
 Cement Seal(s) 37.5 to 0 feet  
75 to 60.5 feet  
 Cement Composition Portland Type II with 10% Quik-Gel and 7 gal H<sub>2</sub>O/94 lb cement  
 Protective Casing 1-5 to 0 feet  
 Protective Casing Type 6" steel with lock and cap  
 Other PVC slip cap on top of completion string; PVC screw cap at base of completion string

WELL DEVELOPMENT: String

Method Air lift

Duration 3 hrs Estimated production gpm  
 Water Appearance clear 9°C

Remarks: Top bentonite seal was a combination of 1.5 ft bentonite pellets and 4 ft Quik Gel slurry. OK'd by Dennis Elrod.

03/04/88

LITHOLOGIC LOG  
PROSPECTOR SQUARE

Page 1 of 2

WELL DRILLING NO. 68-MW-14

ELEVATION (MSL)

BORING COMPLETION DATE 01/24/88

DRILLING METHOD AIR ROTARY

LOCATION PARK CITY, CARTIER PROPERTY  
SW/SW/SE SEC 4, T 25, R 4 E

DRILLING CONTRACTOR DAVENS DRILLING

WATER LEVEL (ft ENCOUNTERED) 25.00

RIG TYPE SP 7000

STATIC WATER LEVEL (ft. SGS) 27.70

LOGGER YC/KM

(SGS = Below Ground Surface)

Depth in ft	LithoI. Column	Sample Type ID	LITHOLOGIC DESCRIPTION	COMMENTS
0		GRAB	LOAM, dk brn	
5		GRAB	GRAVEL, w/sit & sry loam	
10		GRAB	GRAVEL	
15		GRAB	GRAVEL, cldr & col; containing Calc, biot, qtz, FeS2, K-soar & sitst	
20		GRAB	CLAY, 20-30%, w/gvl	
25		GRAB	CLAY & GRAVEL, lt brn, sqng clasts	
30		CORE	No sample	Spl son 37-38.5'; 0% rcv
35		GRAB	GRAVEL, p srtd, qtz, sitst, K-soar, Woodside sh chps	
40		GRAB	CLAY, w brn, w/c sd	
45		GRAB	GRAVEL, c, w/cly; & SAND, cly, Calc cmt; ls rk chos	Spl son 60-61.5'
50		GRAB		
55		GRAB		
60		CORE		

Well: PS-MW-14

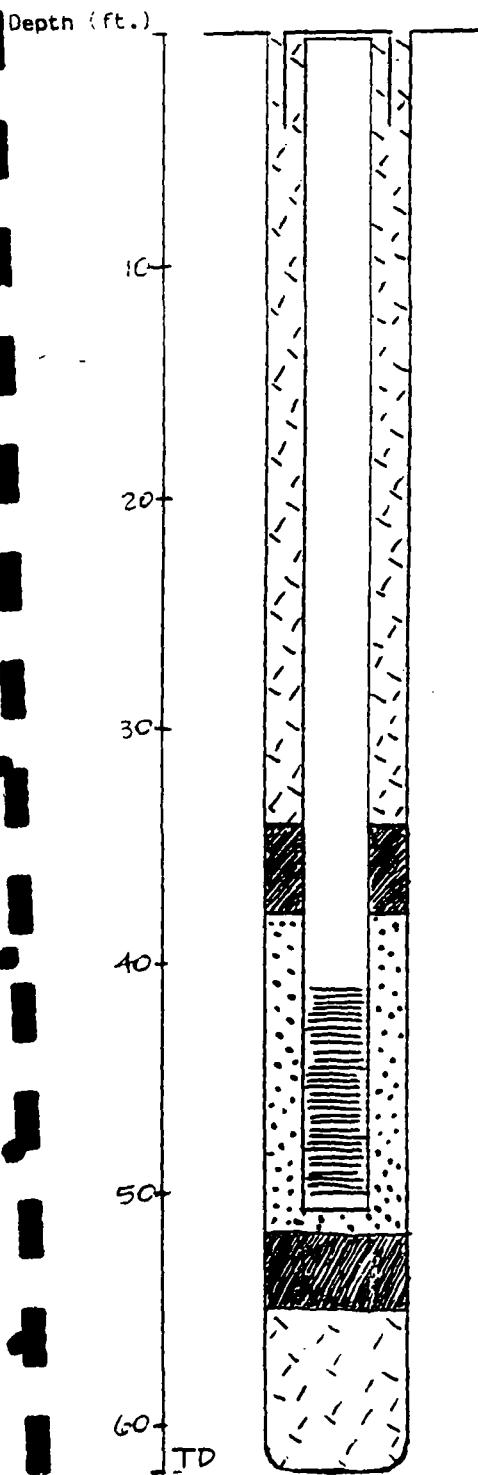
PARK CITY, CARTIER PROPERTY

70	GRAB	SHALE, carb., & LIMESTONE	Woodside sh; Thanes ls
	GRAB	TD = 75'	

WELL/PIEZOMETER COMPLETION DIAGRAM

Project Prospector Square  
 Location Park City, Utah  
 Geologist Mike Cormier/Ken Mall  
 Depth to Water 8.7 feet (G.L.)

TDO No. F08-4611-34  
 Well Number PS-MU-13  
 Date(s) of Installation 1/24/88  
 Elevation from Measuring Point \_\_\_\_\_



DRILLING SUMMARY:

Driller Dave's Drilling  
 Rig Type Schlumberger Pneumatic 7000, no rotary w/casing  
 Drilling Method Air rotary casing, drill and hammer  
 Bit(s) tri-cone 2 1/2" diamond stud  
 Drilling Fluid City water

Surface Casing 4" steel with locking steel cap  
 Hollow Stem/Drive Casing I.D. (in.) 7 7/16"  
 Total Depth of Boring (ft.) 51  
 Borehole Diameter (in.) 7 7/8"

WELL DESIGN:

Completion	Above Grade	Below Grade	Type	
Basis: Geological Log ✓	Geophysical Log	✓	split spoon samples and cuttings sample	
Total Depth of Well (ft.) <u>51</u>				
Casing String(s): C=casing S=screen				
51 - 41	S	-		
41 - 0	C	-		
Casing: PVC 2", Sched 80, flush joint				
Screen: PVC, 20-slot screen				
Centralizers	none used			
Gravel/Sand Pack	52	to	58	feet
Colorado Silica Sand 10-30 mesh				
Bentonite Seal(s)	38	to	34	feet
	55	to	52	feet
Bentonite (type)	Quik Gel + pellets			
Backfill (cuttings)	-	to	-	feet
Cement Seal(s)	62	to	55	feet
	74	to	0	feet
Cement Composition	Portland Type II w/10%			
Quik Gel and 7 gal H2O per 94 lb sack				
Protective Casing	4 1/2"	to	0	feet
Protective Casing Type	4"	steel w/steel locking		
Other	PVC slip cap on top of completion string; PVC screw cap on bottom			

WELL DEVELOPMENT

Method Air lift

Duration 3 hrs Estimated production 0.65 gpm  
 Water Appearance clear, 9°C

Remarks: Conductivity: 7150 umhos (@ 25°C) @ 1150  
 4440 umhos @ " " 1325  
 3500 umhos @ " " 1444

03/04/88

LITHOLOGIC LOG  
PROSPECTOR SQUARE

Page 1 of 1

WELL BORING NO. PG-MW-13  
 LOCATION PARK CITY, RACQUET CLUB  
 SW/NW/SE SEC 4, T 2 S, R 4 E  
 DRILLING CONTRACTOR DAVE'S DRILLING  
 RIG TYPE DP 7000  
 LOGGER MC/KM

ELEVATION (MSL)

BORING COMPLETION DATE 01/21/88

DRILLING METHOD AIR ROTARY

WATER LEVEL 1st ENCOUNTERED (ft. BGS) 10.00

STATIC WATER LEVEL (ft. BGS) 3.70

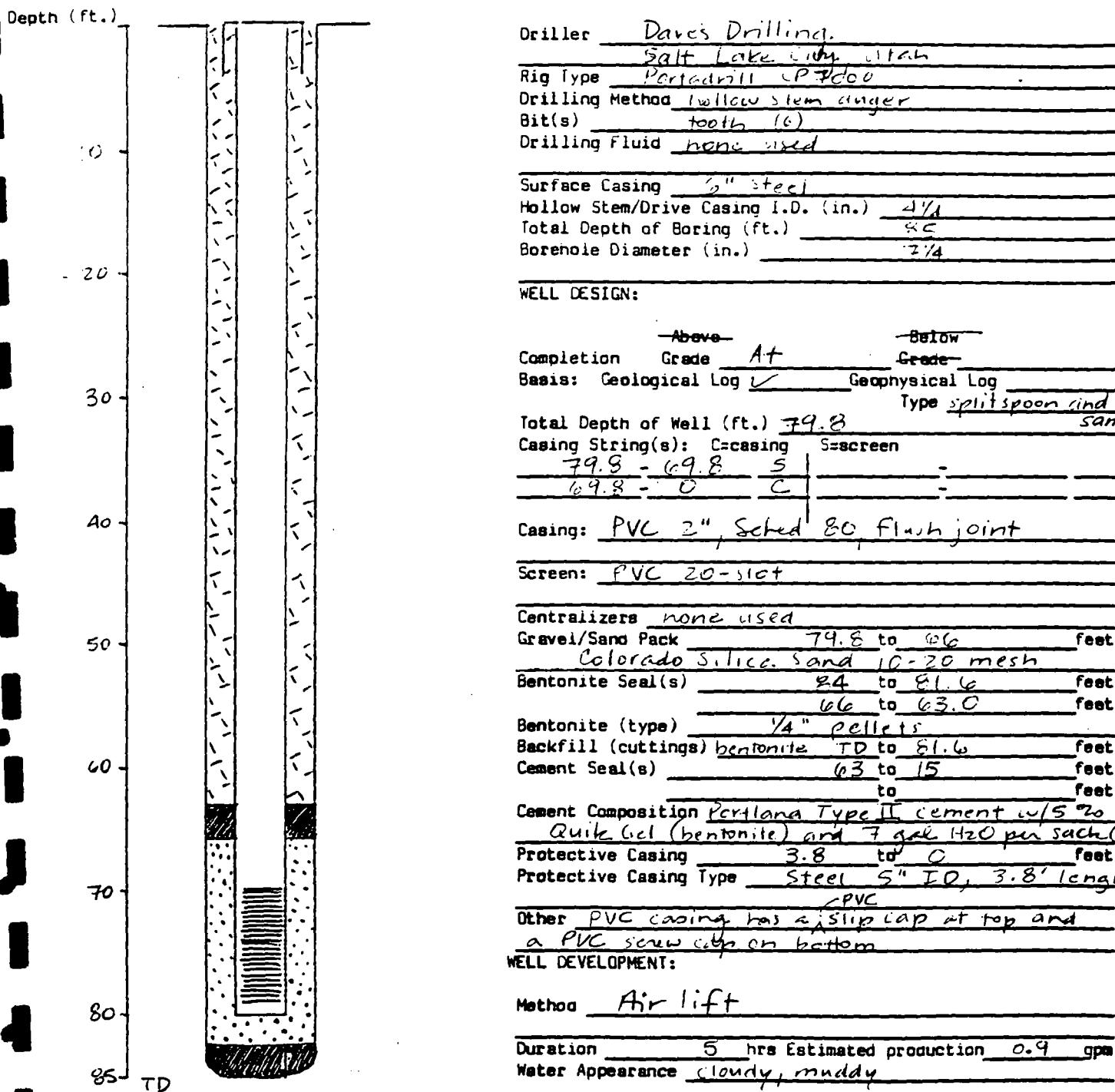
(BGS = Below Ground Surface)

Depth in ft	Lithoi. Column	Sample Type ID	LITHOLOGIC DESCRIPTION	COMMENTS
0	GRAB		CLAY & SILT, n brn, w/1/8" sct gvi	
10	GRAB		CLAY, n brn, moist	
15	GRAB		CLAY & GRAVEL, w/cbls 2-3", spang	
20	CORE		CLAY, lt brn, silty, l to m plas; & SAND, f to v f; lmn, hem, & Mn stn; no org	Sol son 20-21.5'; CL
25	GRAB		CLAY, w/s cbls, 1-2", p srtd, spang to sbnd	
30	GRAB		CLAY/SAND/GRAVEL, brn, p srtd	
35	GRAB		GRAVEL, c to v c obl gvi, spang, w/cly & sd	Gvi 60%, sd 30%, cly 10%
40	CORE		CLAY, n brn, tt, w/v f sd & intbd spang gvi; lmn & hem stn (2X)	Sol son, 40-41.5'; 100% rcv; CL
45	GRAB			41.5-54, cly, sd, gvi; gvi cont may be incr w/depth
50	GRAB			Sd/gvi @ 54'
55	GRAB			
60	GRAB		LIMESTONE, lt gy to wh, mas, w coactd; some sh (Tr) chps	
	GRAB		TD - 61'	Refusal 61'

WELL/PIEZOMETER COMPLETION DIAGRAM

Project Prospector Square  
 Location Park City, Utah  
 Geologist Ken Moll/Diane Coker  
 Depth to Water \_\_\_\_\_ feet (G.L.)

TOD No. FGR - SG11 - 34  
 Well Number PS - MW - 11D  
 Date(s) of Installation 2/7/88  
 Elevation from Measuring Point \_\_\_\_\_



10/04/86

LITHOLOGIC LOG  
PROSPECTOR SQUARE

Page 1 of 1

WELL DRILLING NO. 10-000-10

ELEVATION (ft MSL)

BOREHOLE COMPLETION DATE 10/05/86

LOCATION Park City, town sec 3, range 3  
SE/SE/SW/SE SEC 3, T 2 S, R 4 E

DRILLING METHOD hollow stem auger

DRILLING CONTRACTOR Dave's Drilling

WATER LEVEL (ft) ENCOUNTERED (ft. BGS)

RIG TYPE Portacrill

STATIC WATER LEVEL (ft. BGS)

LOGGER MM/DC

(BGS = Below Ground Surface)

Depth in ft	Lithol. Column	Sample Type ID	LITHOLOGIC DESCRIPTION	COMMENTS
		GRAB	SOIL, clty, silty	
		GRAB	GRAVEL	
		GRAB	CLAY, silty, w/4" layer of decomposed straw	
		GRAB	GRAVEL, silty, w/v f sd	
10		CORE	GRAVEL, c, w/v f sd & silt; c srted, ang to srted; w/ epidote, serpentinite nrris, qtz, illid, sh, rk chcs	Sol son drvn 10-11.5': 40% revy
		GRAB	SILT, dk brn, w/gvl & v f to f sd	
		CORE	CLAY, dk gy, sticky, v clst; & GRAVEL, c, c srted, ang to srted	Sol son 15-16.5', 25% revy
20		CORE	CLAY, dk gy, no clst, v stiff	Sol son 20-21.5': 100% revy
30		CORE	SAND, lt brn, v f to crs, w srted, sbang to srted	Sol son 30-31.5': 80% revy
		GRAB	SAND, c, w/gvl	
40		CORE	GRAVEL, v c to cbls; s srted, ang to rd	Spl son 40-41.5'; 40% revy
50		CORE	CLAY, lt brn, silty, tt	Spl son 50-51.5'; 30% revy
		CORE	SAND, lt brn, c, w/ gvl; silt 30%; and qtz pbls	Sol son 55-56.5'; 100% revy
60		CORE	CLAY, r brn (25% hem), l clst, tt; w/GRAVEL, c	Sol son 65-66.5'; blw ct 200 ttl; 80% revy

Well: PS-new-112

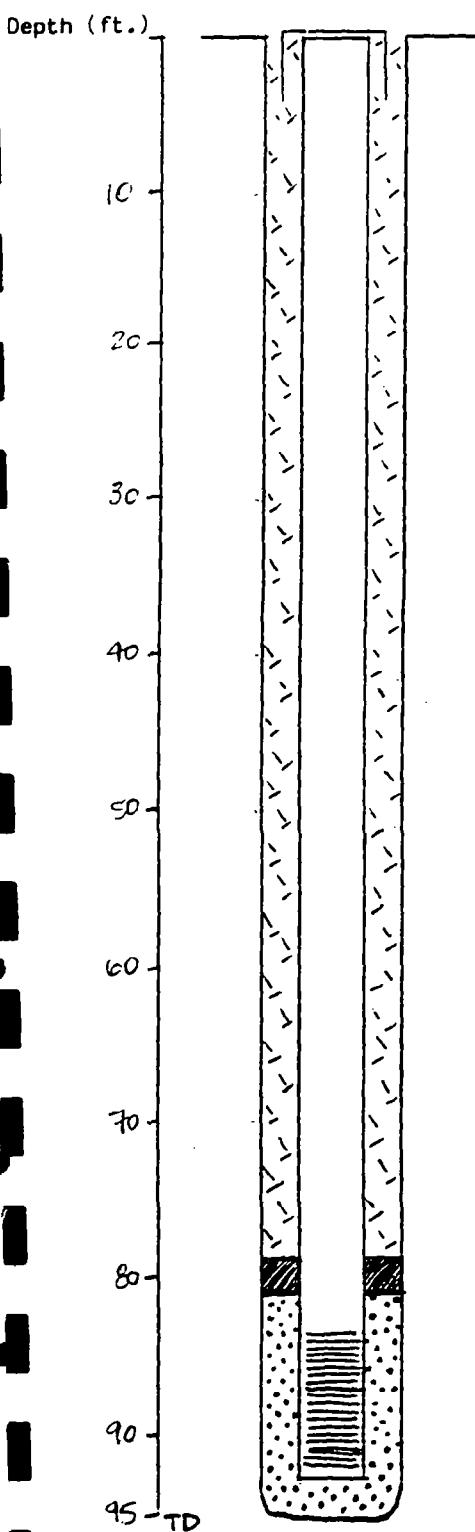
Part: Silty, stony silt, loamy s.

- 73	GRAB	SAND. Lt brn. silty, w/sm amt clst	
-	CORE	SAND. Lt tan. f to e	Soil son 75-76.5'
- 60	CORE	SAND. Lt brn. w spts. grds from f at top of soil to c at bottom of soil barrel; crst. flid. rx cnos	Soil son 80-81.5': 70% revy; "fill"??
	CORE	TD - 65'	Soil son 85-86.5': 0% revy; refusal @ 85'

WELL/PIEZOMETER COMPLETION DIAGRAM

Project Prospector Square  
 Location Park City, Utah  
 Geologist Mike Carmien  
 Depth to Water 20 feet (G.L.)

TDD No. FCE - 8611-34  
 Well Number PS-MW-5D  
 Date(s) of Installation 2/22/88  
 Elevation from Measuring Point \_\_\_\_\_



DRILLING SUMMARY:

Driller Dave's Drilling  
 Salt Lake City, Utah  
 Rig Type Pertadrill, CP 7000  
 Drilling Method Hollow Stem Auger  
 Bit(s) tooth  
 Drilling Fluid none used

Surface Casing 6" Steel w/locking steel cap  
 Hollow Stem/Drive Casing I.D. (in.) 1 1/4"  
 Total Depth of Boring (ft.) 95  
 Borehole Diameter (in.) 7 1/4

WELL DESIGN:

Completion	Above	Below	
	Grade	Grade	<input checked="" type="checkbox"/>
Basis: Geological Log	<input checked="" type="checkbox"/>	Geophysical Log	
Total Depth of Well (ft.)	95		
Casing String(s): C=casing S=screen			
9 3/8 - 8 3/8	S	-	
8 3/8 - C	C	C	
Casing: PVC 2" Sched 80 flush joint			
Screen: 1 PVC 2" 2C slot			
Centralizers	none used		
Gravel/Sand Pack	9 5/8 to 2 1/2		feet
	18-20 mesh Colorado silica sand		
Bentonite Seal(s)	8 1/2 to 7 9/16		feet
	to		feet
Bentonite (type)	Volclay 1/4" pellets		
Backfill (cuttings)	to		feet
Cement Seal(s)	7 9/16 to C		feet
	to		feet
Cement Composition	Portland Type II cement grout w/5% Quik Gel and 7 gal H2O per 94-lb sack cement		
Protective Casing	8 1/2 to 7 9/16		feet
Protective Casing Type	6" Steel w/locking cap		
Other			

WELL DEVELOPMENT:

Method Air lift  
 Duration 3.5 hrs Estimated production gpm  
 Water Appearance silty w/fines  
 Remarks: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

LITHOLOGIC LOG  
PROSPECTOR SQUARE

Page 1 of 2

BORING NO. PS-MM-50  
LOCATION SIDEWINDER DRIVE

ELEVATION (MSL) 0

BORING COMPLETION DATE 02/22/88  
DRILLING METHOD HOLLOW STEM AUGER

DIGGING CONTRACTOR DAVE'S DRILLING  
G TYPE PORTADRILL  
GGER CARMEN

WATER LEVEL 1st ENCOUNTERED (ft,BGS) 25.00  
STATIC WATER LEVEL (ft,BGS) 20.00  
(BGS = Below Ground Surface)

Depth in ft	Lithol. Column	Sample Type ID	LITHOLOGIC DESCRIPTION	COMMENTS
		CORE	REFER TO WELL PS-MM-5 FOR DESCRIPTION OF LITHOLOGY FROM 0-12 FT	8" SURFACE CASING CEMENTED FROM 0-12 FT
		CORE	CLAY, reddish brown, matrix mixed with fine to coarse sand, angular to subangular.	Split spoon driven from 20-21.5 ft; 40% recovery
3				
1				
40		CORE	GRAVEL/CLAY/SAND, poorly sorted, 25% gravel, 60% clay, 15% sand; clay reddish brown, sand med to coarse, angular to subangular	Split spoon driven 40-41.5 ft; 60% recovery.
50				
60		CORE	CLAY, reddish brown, plastic, moist, very fine silt within matrix; clay tight, consistent.	Split spoon driven 60-61.5 ft; 100% recovery.
70				

Well: PS-MW-5D

## SIDEWINDER DRIVE

80		CORE	CLAY/GRAVEL, clay reddish brown, intermixed with angular to subangular 0-1" sandstone chips; some evidence of Woodside shale; purplish staining.	Split spoon driven 80-81.5 ft; 85% recovery.
90		CORE	Drilling has ceased due to presence of natural gas in bore-hole.	Drilling stopped at request of Park City, USGS, and E & E.

## ABBREVIATIONS

## USED IN LITHOLOGIC LOG DESCRIPTIONS

About	abt
Angular	ang
Approximate, Approximately	aprox
Average	av
Biotite	biot
Black	blk
Boulder	bldr
Brown	brn
Calcite, Calcareous	calc
Carbonaceous	carb
Cement, Cemented	cmt
Clay, Clayey	cly
Coarse	c
Cobble	cbl
Compact	cpct
Crossbedded	xbd
Crystal	xi
Cuttings	ctgs
Dark	dk
Decrease	decr
Driven	drv
Feldspar	fld
Fine	f
Fragment	frag
Grade	grd
Gravel	gvl
Green	gn
Hard	hd
Hematite	hem
Increase	incr
Interbedded	intbd
Light	lt
Limonite	lmn
Little	ltl
Material	mat
Matrix	mtx
Medium	m
Mixed	mxd
Part	pt
Pebble	pbl
Pink	pk
Plastic	plas
Poor, Poorly	p
Purple	purp
Quartz	qtz
Quartzite	qtzt
Recovery	rcvy

## ABBREVIATIONS

USED IN LITHOLOGIC LOG DESCRIPTIONS  
(CONTINUED)

Sand	sd
Sandy	sdy
Shale	sh
Silt	slt
Silty	slty
Size	sz
Small	s
Soft	sft
Sorted	srted
Split	spl
Spoon	spn
Stain	stn
Streak	str
Subangular	sbang
Subrounded	sbrd
Tight	tt
Very	v
Weather	wthr
Weathered	wthrd
Well	w
White	wh
With	w/
Without	w/o
Yellow	y

ATTACHMENT B  
FIELD AUDIT REPORT



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
REGION VIII  
999 18th STREET— SUITE 500  
DENVER, COLORADO 80202-2405

SEP 28 1987

REF: 8ES-ES

MEMORANDUM

TO: Paula Schmittdehl, 8HWM-SR  
Project Officer 

FROM: Lester D. Sprenger, 8ES-TI  
Field Quality Assurance Officer

SUBJECT: Field QA Audit of the Silver Creek Tailings Well Superfund Sampling Activity

I have attached for your use the Field QA Audit on the subject plan. The sampling activity was carried out very effectively and should result in valid and defensible data.

Attachment

cc: (w/attachment) Jim Littlejohn, 8ES-AS  
(w/o attachment) Marshall Payne, 8ES-ES

UNIVERSAL  
FIELD OVERVIEW  
CHECKLIST

Site Name Silver Creek Tailings

Location Park City, Utah

Study Date(s) 8/31 and 9/1/87

Facility Contact Ron Ivie

Phone Number 649-9321

Contractor/State Personnel Jim Mason - USGS

Address Salt Lake City, Utah

Phone Number \_\_\_\_\_

Project Leader Muhammad Slam - UBSHW

Other Contractor/State Personnel \_\_\_\_\_

ESD Overview Personnel Lester D. Sprenger

Other Personnel and Affiliation \_\_\_\_\_  
Ken Thompson - USGS  
Mike Long - UBSHW  
Robert Eddy - E&E  
Dan Kenney - E&E  
Paula Schmittdehl - EPA

PLANNING AND PREPARATIONY or N

- 1) Was a study plan, work plan, site operations plan, etc. issued for this investigation? Y

Date Issued 6/22/87

If YES:

Was the study plan reviewed by ESD? YWas the study plan acceptable? YSAMPLINGGeneral Procedures

- 1) Were sampling locations properly selected? Y

If No, explain \_\_\_\_\_

- 2) Were samples collected starting with the least likely contaminated and proceeding to the most likely contaminated? Y

Remarks \_\_\_\_\_

- 3) Were new disposable rubber gloves worn during collection of all samples? Y

Remarks \_\_\_\_\_

- 4) Was sampling equipment wrapped in aluminum foil and protected from possible contamination prior to sample collection? N

If No, explain Sample equipment is kept in clean carrying bags. \_\_\_\_\_

- 5) If equipment was cleaned in the field, were proper procedures used? (This includes storage method for rinse water and solvents) Y

If No, explain \_\_\_\_\_

- 6) What field instruments were used during this investigation? \_\_\_\_\_  
pH meter and conductivity meter \_\_\_\_\_

- |  | <u>Y or N</u>        |
|--|----------------------|
| 7) Were field instruments properly calibrated?   | <u>y</u>             |
| If No, explain _____<br>_____<br>_____   |                      |
| 8) Were calibration procedures documented in the field notes?<br>Remarks _____<br>_____<br>_____   | <u>y</u>             |
| 9) Were the samples chemically field preserved?<br>If No, explain _____<br>_____   | <u>y</u>             |
| 10) Were the samples iced?<br>_____  | <u>y</u>             |
| 11) Were samples for selected parameters field filtered?<br><br>If Yes, list parameters and describe procedures.<br><u>Meters - 0.45 micron filter using a peristaltic pump.</u><br>_____<br>_____               | <u>y</u>             |
| <br><u>Well Sampling</u>   |                      |
| 1) Was depth of well determined?<br>_____  | <u>y</u>             |
| 2) Was depth to water determined?<br>_____   | <u>y</u>             |
| 3) Were the above depths to water converted to water level elevations common to all wells?<br><br>Describe how the depths were determined<br><u>Surveyed by J.J. Johnson, Park City, Utah.</u><br>_____<br>_____ | <u>y</u>             |
| 4) How was the volume of water originally present in each well determined? <u>with a steel tape measure</u><br>_____<br>_____  |                      |
| 5) Was the volume determined correctly?<br>_____   | <u>y</u>             |
| 6) How was completeness of purging determined?<br>Volume<br><u>Measure X</u><br><u>Time/Flow rate</u><br><u>Cond./pH/T</u><br>_____  |                      |
| 7) Was a sufficient volume purged?<br><br>Was the well over-purged?<br>_____   | <u>y</u><br><u>N</u> |

	<u>Y or N</u>
8) Was a dedicated (in-place) pump utilized?	<u>N</u>
If no, describe the method of purging (bailer - include type and construction material, pump - include type) <u>A PVC Brainard Kelman pump was used.</u>	
9) How were the samples collected?	
Bailer _____	
Pump <u>X</u> _____	
Combination _____	
Construction material of bailer: _____	
Design of bailer	
Open Top _____	
Closed Top _____	
Other _____	
10) If a pump was used, describe how it was cleaned before and/or between wells.	<u>Soapy water, rinsed with water.</u>
11) Was the sample properly transferred from bailer to sample bottle (i.e., was the purgeable sample agitated, etc.)?	<u>Y</u>
12) Was the rope or line allowed to touch the ground?	<u>N/A</u>
13) Was any wetted rope or line discarded after use at each well?	<u>N/A</u>
14) How many wells were sampled?	<u>7</u>
<u>Surface Water Sampling</u>	
1) What procedures and equipment were used to collect surface water samples?	<u>N/A</u>
_____ _____	
Who collected samples? _____	
2) Did the samplers wade in the stream during sample collection?	<u>N/A</u>
If Yes:	
Did the sampler face upstream while collecting sample? _____	
Did the sampler insure that roiled sediments were not collected along with water sample? _____	
_____	

Y or N

- 3) Note any deficiencies observed during the collection of the surface water samples \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Waste, Sludge, Soil/Sediment Sampling

- 1) What procedures including equipment were used to collect soil/sediment samples? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
- 2) Were the soil/sediment samples well mixed prior to placing the sample in the sample container? \_\_\_\_\_ N/A
- 3) Note any deficiencies observed during the collection of the soil/sediment samples \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Total number of samples collected \_\_\_\_\_

Other Sampling

- 1) What other types of samples were collected during this investigation?  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

- 2) What procedures were used for the collection of these samples?  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Who collected samples?

QUALITY ASSURANCE/QUALITY CONTROL

Y or N

(While all of these QA/QC procedures are not necessarily used, please identify the specific techniques which were employed by sampling personnel.)

- 1) Did the sampling personnel utilize any field trip blanks? \_\_\_\_\_ Y

Y or N

2) Did the sampling personnel utilize preservative blanks? N

If Yes, to either of the above questions, list the types and handling of the blanks \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

3) Were any equipment blanks collected? Y

If Yes, list: Deionized organic-free water was poured through sampling equipment - 1 sample collected  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

4) Were any duplicate samples collected? Y

If Yes, list the types (parameter coverage, etc.) and describe their handling. one sample for all parameters - handled as a regular sample  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

5) Were any spiked samples utilized? N

If Yes, list the types (parameter coverage, etc.) and describe their handling. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

#### FIELD DOCUMENTATION AND CHAIN-OF-CUSTODY

1) Were split samples offered to the site owner or facility representative? Y

2) Was a receipt for samples given to the site owner or facility representative prior to leaving the site? N/A

3) Were chain-of-custody records completed for all samples? Y

4) Were sample tag numbers and laboratory traffic report form numbers cross referenced to chain-of-custody forms? Y

5) Were chain-of-custody form numbers recorded in the field log book? Y

6) Were all samples properly sealed at the time of collection? Y

7) Were samples locked in vehicle or kept in a secure place after collection? Y

Y or N

8) Were all sample tags and chain-of-custody forms signed by sample collector(s)? Y

9) Were sampling locations adequately documented? Y

If No, explain \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

10) Was sampling documented with photographs? Y

If Yes, was a photolog maintained?

11) Were the samples shipped to a contract laboratory? N

If Yes:

Were the traffic report forms filled out properly? \_\_\_\_\_

Were the samples properly packed for shipment? \_\_\_\_\_

STATE REGULATORY AGENCY PERSONNEL

Y or N

Qualifications of investigative/sampling personnel (training and experience) by names \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Have investigative/sampling personnel received sampling technique and equipment training? Y

Have personnel received safety training? Y

If yes to either of the above questions, list where and when the training was received and who provided the instruction.  
At State offices once a year by EPA or EPA contractor. \_\_\_\_\_  
\_\_\_\_\_

Do the investigative/sampling personnel undergo periodic refresher training regarding safety? Y

Did the investigative/sampling personnel have appropriate safety equipment in their possession during this inspection? Y

If YES, describe the equipment which was available and/or used during this inspection. HNu  
\_\_\_\_\_  
\_\_\_\_\_

If NO, list the equipment which was needed. \_\_\_\_\_  
\_\_\_\_\_

Y or N

Have the investigative/sampling personnel been categorized as to the type of inspections they can conduct? Y

Have the investigative/sampling personnel had comprehensive physicals? Y

Do the sampling personnel participate in a medical monitoring program (i.e., periodic follow-up physicals)? Y

If yes, how often? Yearly

Do the investigative/sampling personnel perform the entire RCRA Interim Status Inspection or merely collect samples? N/A

If the personnel only collect samples, how are their sampling efforts coordinated with the rest of the inspection? N/A

If state personnel did not collect samples, did they thoroughly evaluate sampling procedures used by facility? N/A

If facility collected samples, did state representatives accept a split sample(s)? N/A

SOP (Applies only to state overviews)

Has the state developed an SOP for RCRA field sampling? QAPP CERCLA Y

Did the state personnel have a copy of the SOP with them during this inspection? QAPP N

What does the SOP Cover?

Field inspections in general (sampling techniques, etc.)

Sample handling X

Sample I.D. and chain-of-custody X

Uses and limitations of various types of bailers and pumps X

Equipment cleaning X

Field measurements (cond., pH, T, etc.) X

Calibration of field instruments X

Other \_\_\_\_\_

Did they follow their SOP during this inspection? QAPP Y

GENERAL COMMENTS/OBSERVATIONS

The sampling went very well. The data from this sampling activity should be valid and defensible.

At the first sampling site I did have them cut off the brass end of a rubber garden hose which was attached to the well pump. Since the sample plan did not call for organic analysis I had no objection to the use of a rubber garden hose, however, had they been taking samples for organic analysis, I would have had them change to teflon tubing.

ATTACHMENT C  
MODIFICATIONS TO WORK PLAN

#### ADDITIONAL WORK NOT INCLUDED IN ORIGINAL WORK PLAN

During drilling operations of the original 11 monitoring wells, the need for two additional monitoring wells became apparent. Due to the shallow depth at which consolidated rock was encountered in the upgradient, deep, alluvial well, a second deep well was completed to insure that a true representation of the quality of water at depth would be obtained.

Preliminary water-level data from the completed monitoring wells indicated a possible component of ground-water flow in a northeasterly direction, away from the tailings area, in addition to the component of flow along Silver Creek. Therefore, to insure representation of downgradient conditions, an additional monitoring well was completed near the Pace-Homer Ditch, north of the tailings area.

At the request of the U.S. Environmental Protection Agency, additional aquifer characterization was completed in the Silver Creek Tailings area. The additional work was designed to determine whether there is a connection between the unconsolidated valley-fill and the consolidated-rock aquifer used as a municipal water supply. Also, the transmissive properties of the unconsolidated valley-fill would be characterized from lithologic descriptions and slug tests. Three elements of work were included in this phase. First, five, deep, alluvial wells were completed near the consolidated rock. Three of these wells will be used to characterize the lithology and quality of water at depth in the tailings area. The remaining two additional wells were located between the tailings area and the Park Meadows Municipal Well. These wells were monitored during an interference test.

The second element of the additional aquifer characterization involved a 72-hour interference test designed to determine effects of pumping the Park Meadows Well on water levels in the Thaynes Formation, Woodside Shale, unconsolidated valley-fill, and on discharge of springs and streams in the area. All wells, springs, and streams were monitored during the test.

The final element was designed to obtain estimates of horizontal hydraulic conductivity from each of the monitoring wells. These estimates can be derived from data obtained from slug tests of each well. Rather than using a slug of water injected into each well, water can be displaced within the well by a cylinder, and recovery can be monitored.

ATTACHMENT D  
OUTLINE FOR STUDENT T-TEST

R450-1-F  
APPENDIX D

TESTS FOR SIGNIFICANCE

As required in 7.13.4.(b), the owner or operator shall use the Student's t-test to determine statistically significant changes in the concentration or value of an indicator parameter in periodic groundwater samples when compared to the initial background concentration or value of that indicator parameter. The comparison shall consider individually each of the wells in the monitoring system. For three of the indicator parameters (specific conductance, total organic carbon, and total organic halogen) a single-tailed Student's t-test shall be used to test at the 0.01 level of significance for significant increases over background. The difference test for pH shall be a two-tailed Student's t-test at the overall 0.01 level of significance.

The Student's t-test involves calculation of the value of a t-statistic for each comparison of the mean (average) concentration or value (based on a minimum of four replicate measurements) of an indicator parameter with its initial background concentration or value. The calculated value of the t-statistic shall then be compared to the value of the t-statistic found in a table for t-test of significance at the specified level of significance. A calculated value of t which exceeds the value of t found in the table indicates a statistically significant change in the concentration or value of the indicator parameter.

Formulae for calculation of the t-statistic and tables for t-test of significance can be found in most introductory statistics texts.

Cochran's Approximation for the Behrens-Fisher Students<sup>1</sup> t-test.

Using all the available background data ( $N_B$  readings), calculate the background mean ( $X_B$ ) and background variance ( $S_B^2$ ). For the single monitoring well under investigation ( $n_m$  reading), calculate the monitoring mean ( $x_m$ ) and monitoring variance ( $S_m^2$ ).

For any set of data ( $X_1, X_2 \dots X_n$ ) the mean is calculated by:

$$\bar{X} = \frac{X_1 + X_2 + \dots + X_n}{n}$$

and the variance is calculated by:

$$s^2 = \frac{(X_1 - \bar{X})^2 + (X_2 - \bar{X})^2 + \dots + (X_n - \bar{X})^2}{n-1}$$

Where "n" denotes the number of observations in the set of data.

The t-test uses these data summary measures to calculate a t-statistic ( $t^*$ ) and a comparison t-statistic ( $t_c$ ). The  $t^*$  value is compared to the  $t_c$  value and a conclusion reached as to whether there has been a statistically significant change in any indicator parameter.

The t-statistic for all parameters except pH and a similar monitoring parameters is

$$t^* = \frac{x_m - \bar{X}_B}{\sqrt{\frac{S_m^2}{n_m} + \frac{S_B^2}{n_B}}}$$

$$= \sqrt{\frac{S_m^2}{n_m} + \frac{S_B^2}{n_B}}$$

If the value of this t-statistic is negative then there is not significant difference between the monitoring data and background data. It should be noted that significantly small negative values may be indicative of a failure of the assumption made for test validity or errors have been made in collecting the background data.

The t-statistic ( $t_c$ ), against which  $t^*$  will be compared, necessitates finding  $t_B$  and  $t_m$  from standard (one-tailed) tables where,

$t_B$  = t-tables with  $(n_B - 1)$  degrees of freedom, at the 0.05 level of significance.

$t_m$  = t-tables with  $(n_m - 1)$  degrees of freedom, at the 0.05 level of significance.

Finally, the special weightings  $w_B$  and  $w_m$  are defined as:

$$w_B = \frac{s^2}{B} \quad \text{and} \quad w_m = \frac{s^2}{m}$$

and so the comparison t-statistic is:

$$t_c = \frac{\frac{w_B t_B}{B} + \frac{w_m t_m}{m}}{w_B + w_m}$$

The t-statistic ( $t^*$ ) is now compared with the comparison t-statistic ( $t_c$ ) using the following decision rule:

If  $t^*$  is equal to or larger than  $t_c$  then conclude that there most likely has been a significant increase in this specific parameter.

If  $t^*$  is less than  $t_c$  then conclude that most likely there has not been a change in this specific parameter.

The t-statistic for testing pH and similar monitoring parameters is constructed in the same manner as previously described except the negative sign (if any) is discarded and the caveat concerning the negative value is ignored. The standard (two-tailed) tables are used in the construction  $t_c$  for pH and similar monitoring parameters conclude that there most likely has been no change.

A further discussion of the test may be found in Statistical Methods (6th Edition, Section 4.14) by G.W. Snedecor and W.G. Cochran, or Principles and Procedures of Statistics (1st Edition, Section 5.8) by R.G.D. Steel and J. H. Torrie.

---

#### STANDARD T-TABLES 0.05 LEVEL OF SIGNIFICANCE

Degrees of Freedom	t-values (one-tail)	t-values (two-tail)
1.	6.314	12.706
2.	2.920	4.303
3.	2.353	3.182
4.	2.132	2.776
5.	2.015	2.571
6.	1.943	2.447
7.	1.895	2.365
8.	1.860	2.306
9.	1.833	2.262

10.	1.812	2.228
11.	1.796	2.201
12.	1.782	2.179
13.	1.771	2.160
14.	1.761	2.145
15.	1.753	2.131
16.	1.746	2.120
17.	1.740	2.110
18.	1.734	2.101
19.	1.729	2.093
20.	1.725	2.086
21.	1.721	2.080
22.	1.717	2.074
23.	1.714	2.069
24.	1.711	2.064
25.	1.708	2.060
30.	1.697	2.042
40.	1.684	2.021

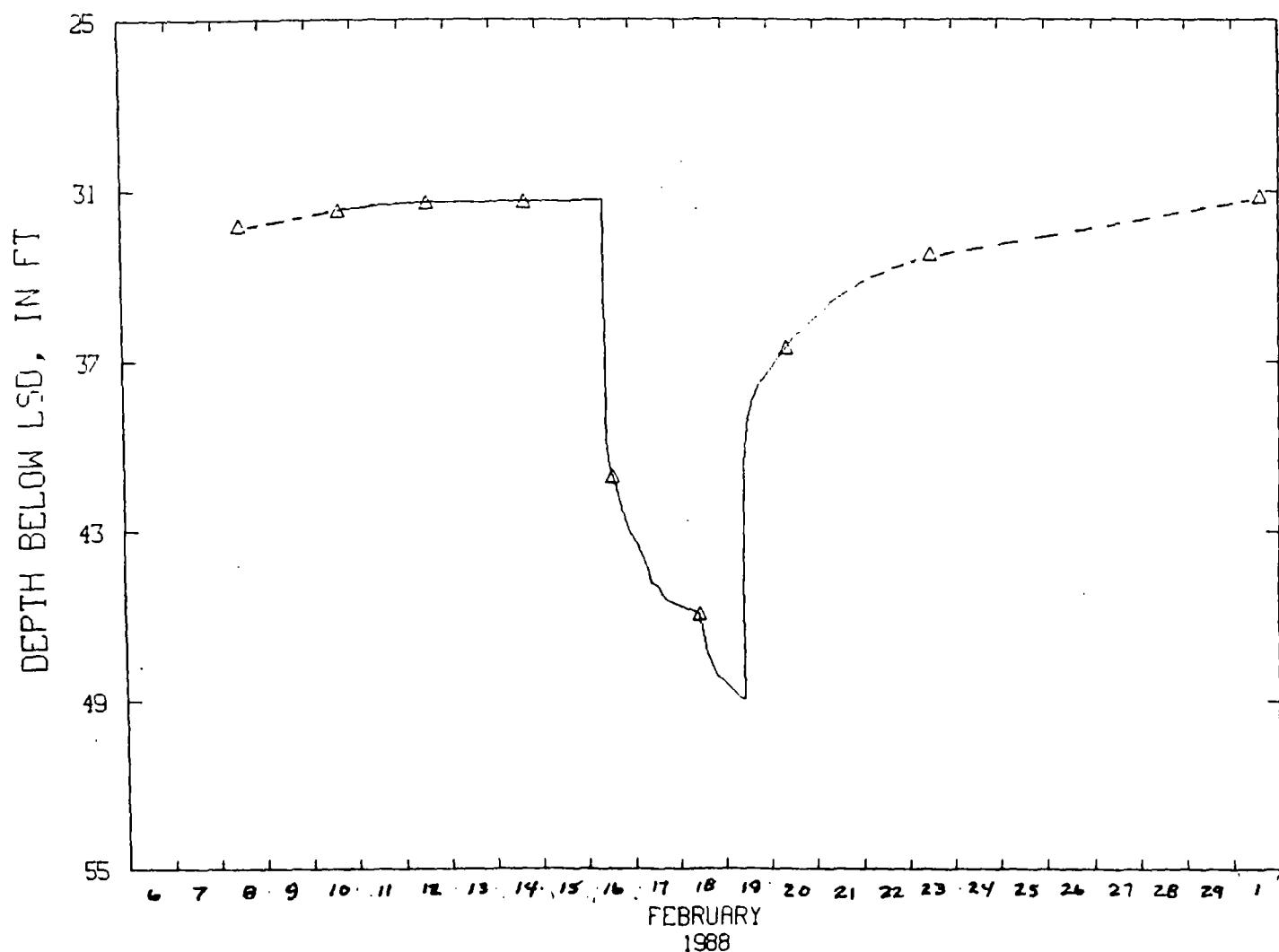
Adopted from Table III of "Statistical Tables for Biological, Agricultural, and Medical Research" (1947, R.A. Fisher and F. Yates).

KEY: Hazardous Waste

1987

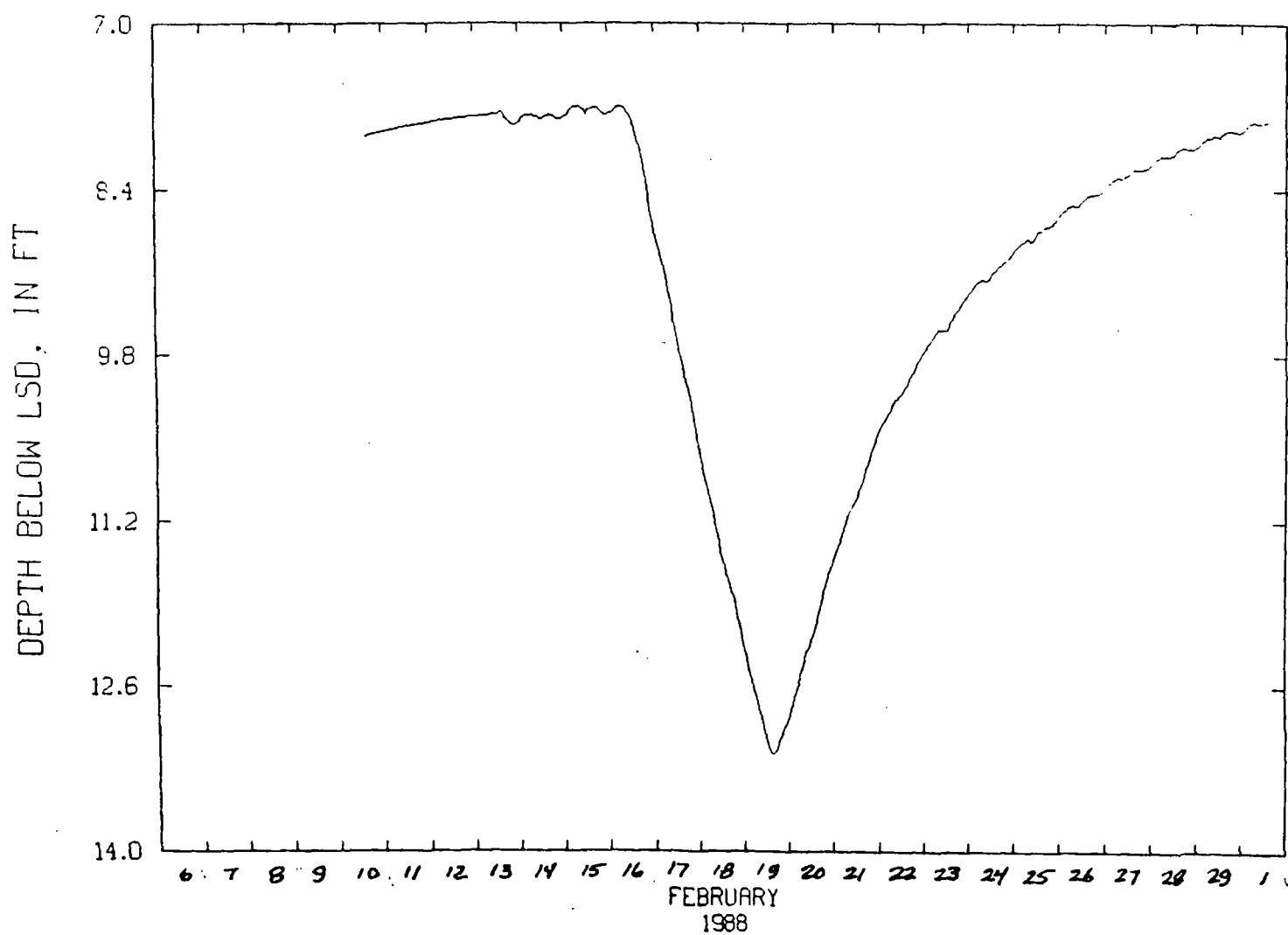
26-14

ATTACHMENT E  
INTERFERENCE TEST DATA



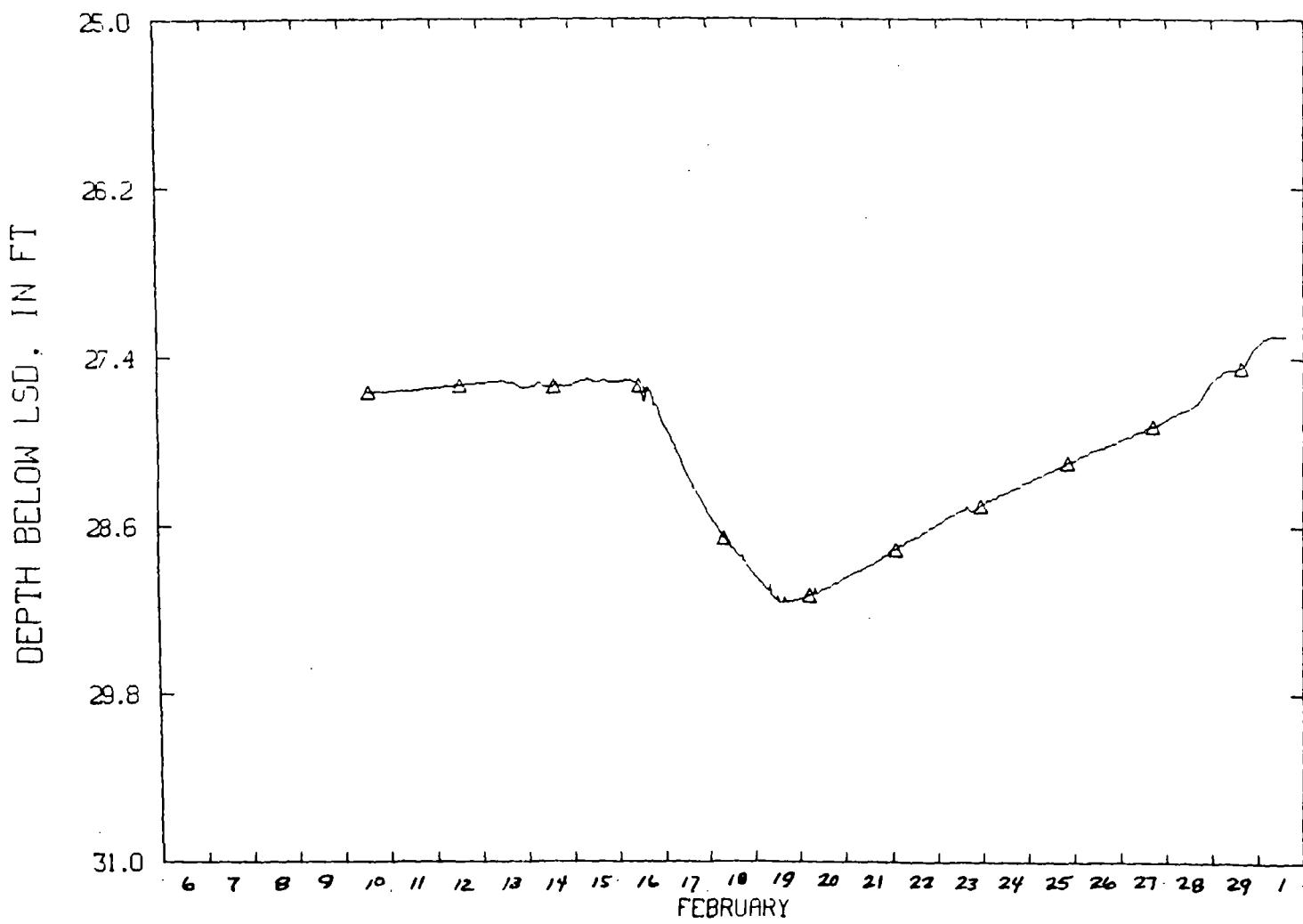
404005111202801 PARK MEADOWS WELL  
INSTANTANEOUS DEPTH BELOW LSD (FT), EDITED

Figure 6.--Fluctuations during interference test (dashed where estimated).



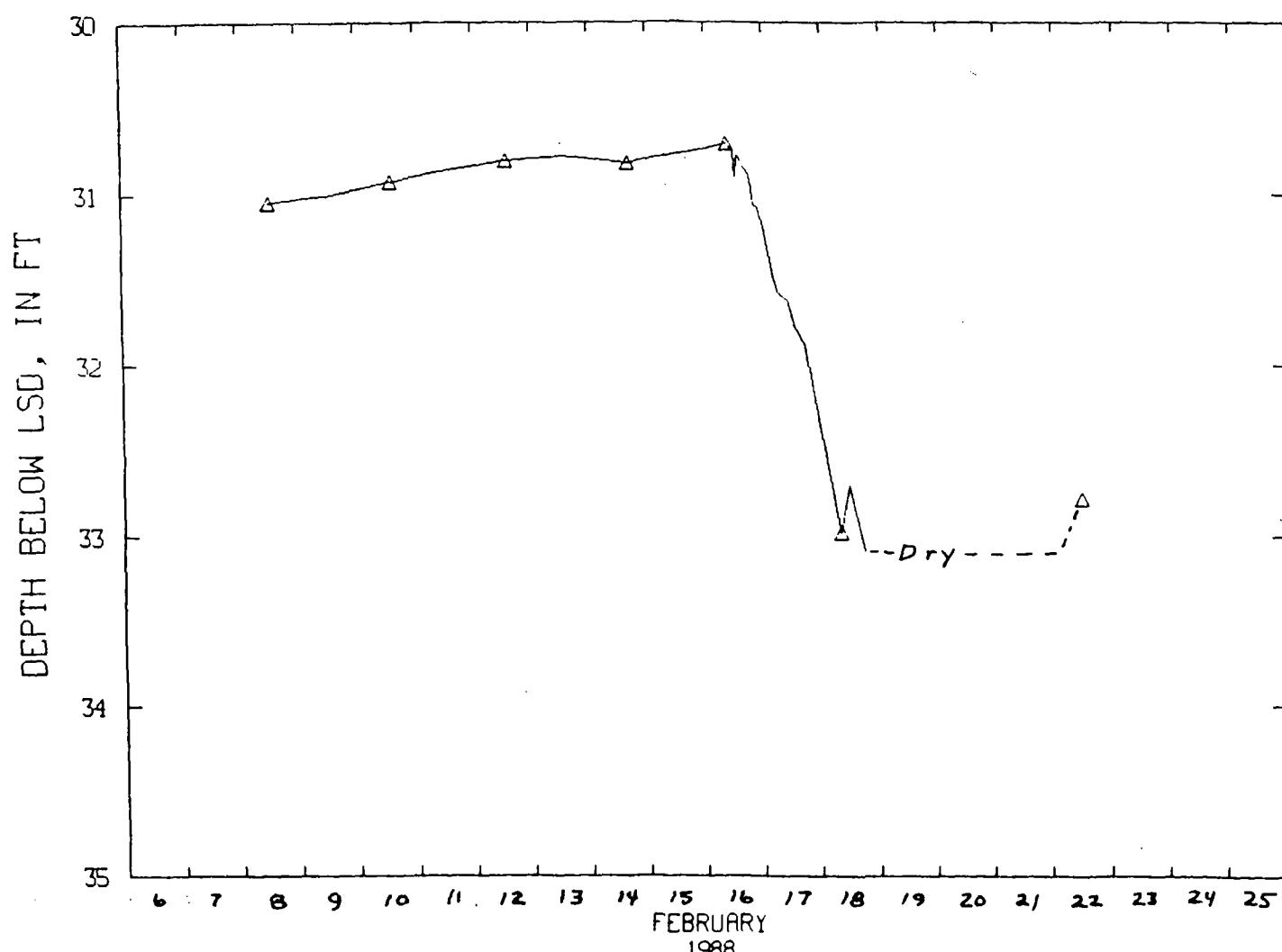
404018111295901 MW-13  
INSTANTANEOUS DEPTH BELOW LSD (FT), FROM DATAPOD, EDITED

Figure 6.--Fluctuations during interference test (dashed where estimated)--Continued.



404007111300101 MW-14  
INSTANTANEOUS DEPTH BELOW LSD (FT), FROM DATAPOD

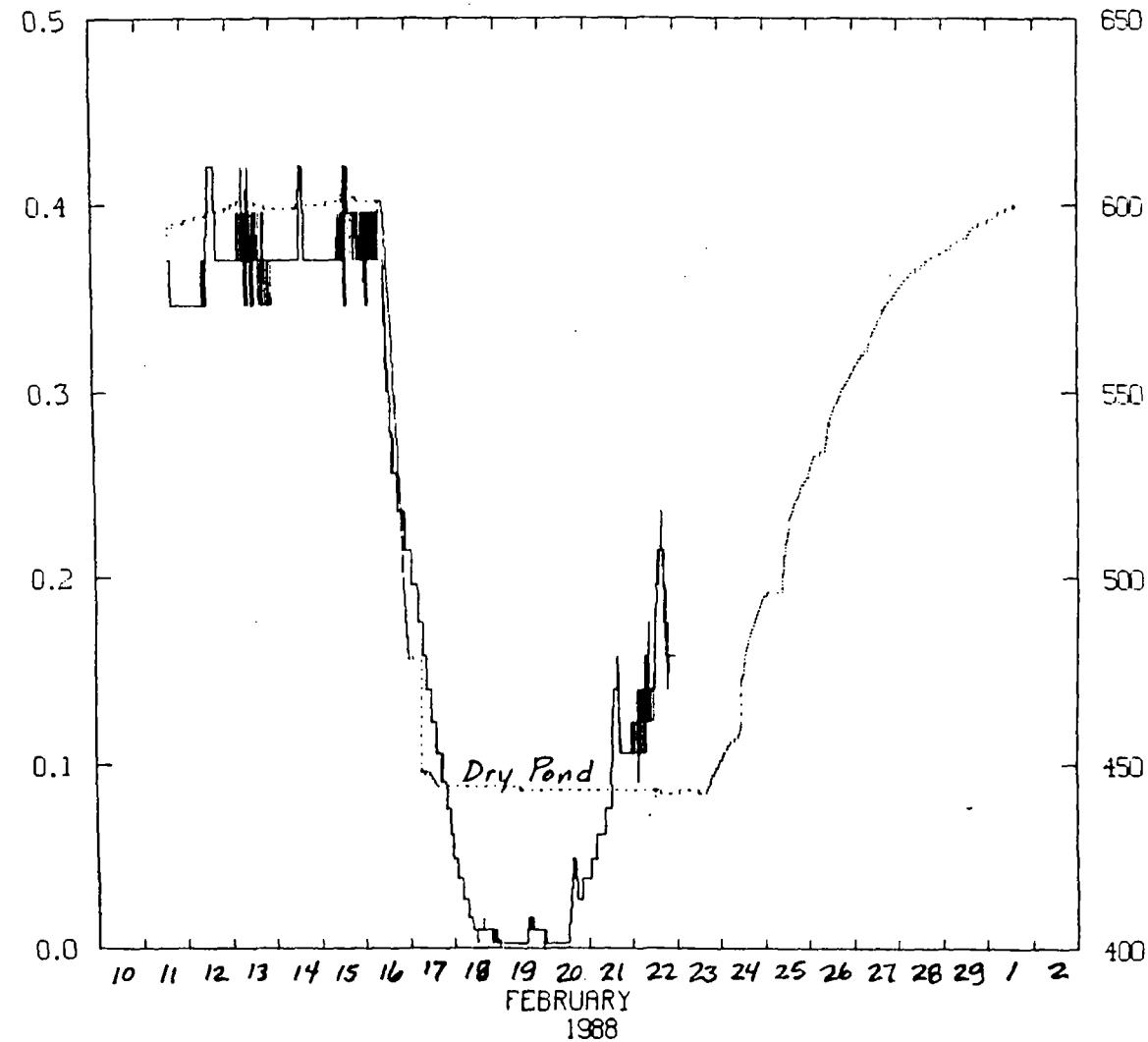
Figure 6.--Fluctuations during interference test (dashed where estimated)--Continued.



404007111295701 CARTIER WELL  
INSTANTANEOUS DEPTH BELOW LSD (FT), EDITED

Figure 6--Fluctuations during interference test (dashed where estimated)--Continued.

404019111295001 DORITY SPRING WEIR NEAR PARK CITY, UTAH  
INSTANTANEOUS DISCHARGE (CFS)

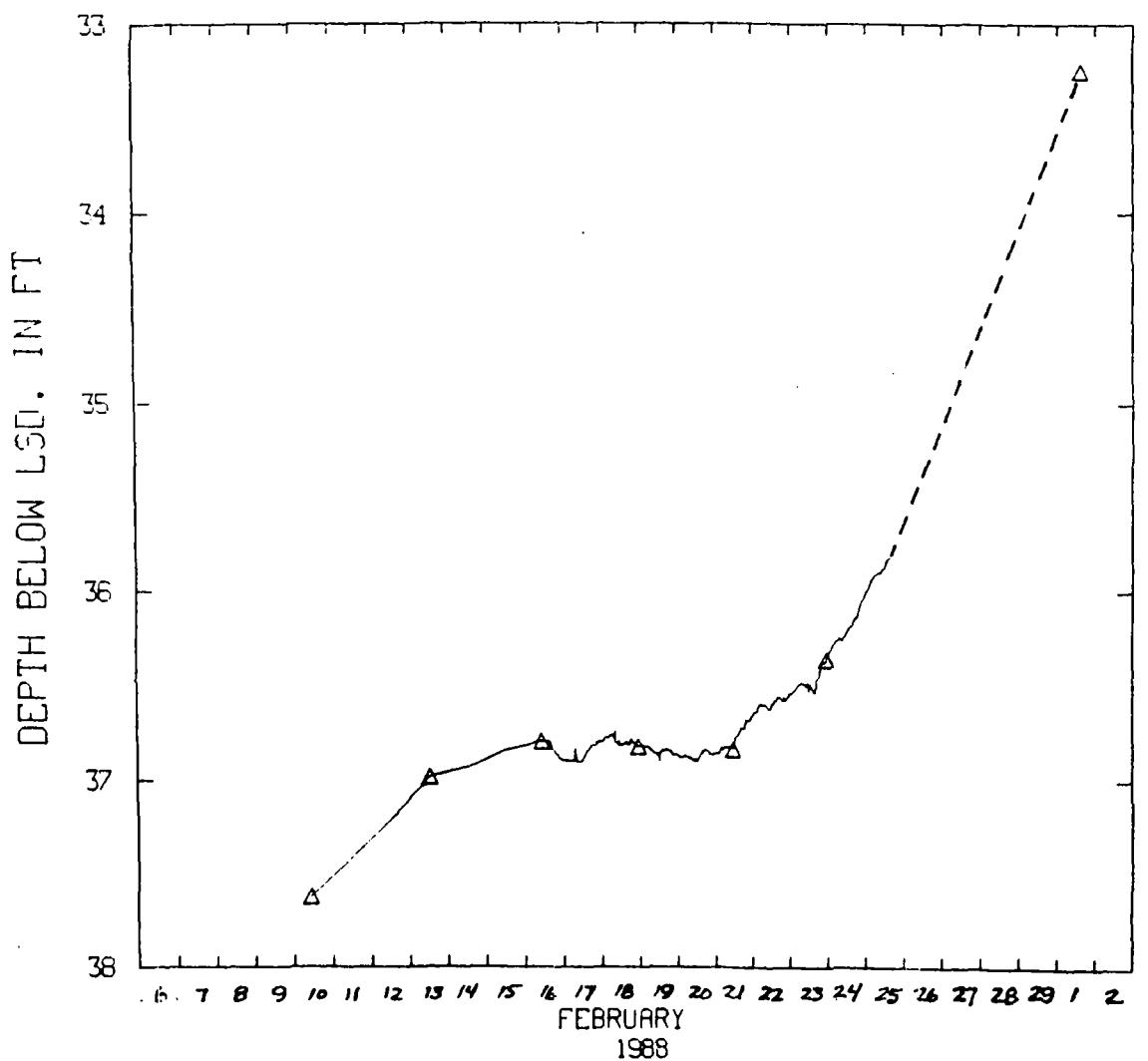


404013111294801 (D- 2- 4) 4DCA-S1  
INSTANTANEOUS GAGE HEIGHT (FEET ABOVE DATUM), POND STAGE, EI

404019111295001 DORITY SPRING WEIR NEAR PARK CITY, UTAH  
INSTANTANEOUS DISCHARGE (CFS)

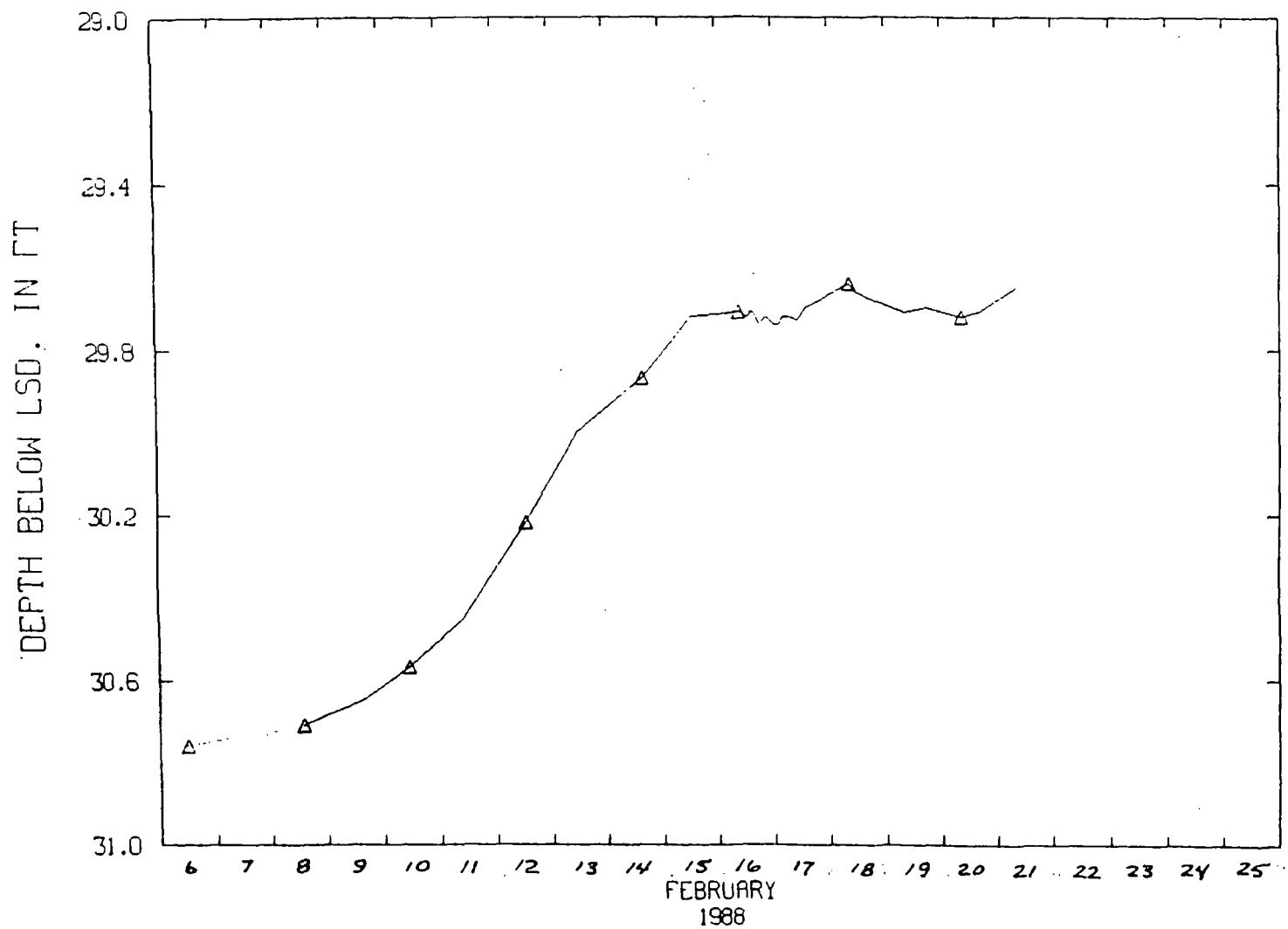
404013111294801 (D- 2- 4) 4DCA-S1  
INSTANTANEOUS GAGE HEIGHT (FEET ABOVE DATUM), POND STAGE, EDITE

Figure 6.--Fluctuations during interference test (dashed where estimated)--Continued.



40394611300302 MW-1D  
INSTANTANEOUS DEPTH BELOW LSD (FT), FROM DATAPOD, EDITED

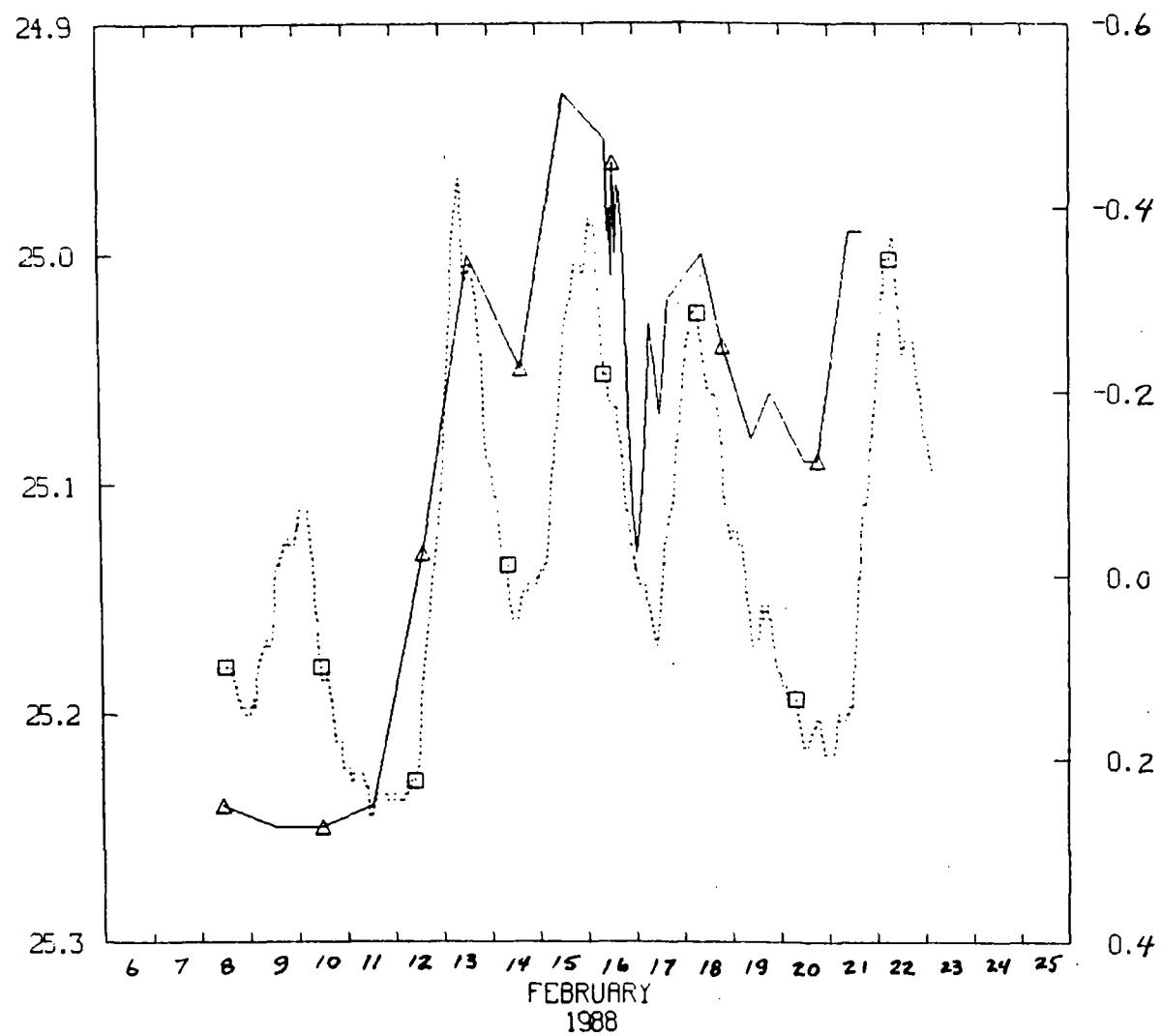
Figure 6.--Fluctuations during interference test (dashed where estimated)--Continued.



403946111300301 MW-1S  
INSTANTANEOUS DEPTH BELOW LSD (FT), EDITED

Figure 6.--Fluctuations during interference test (dashed where estimated)--Continued.

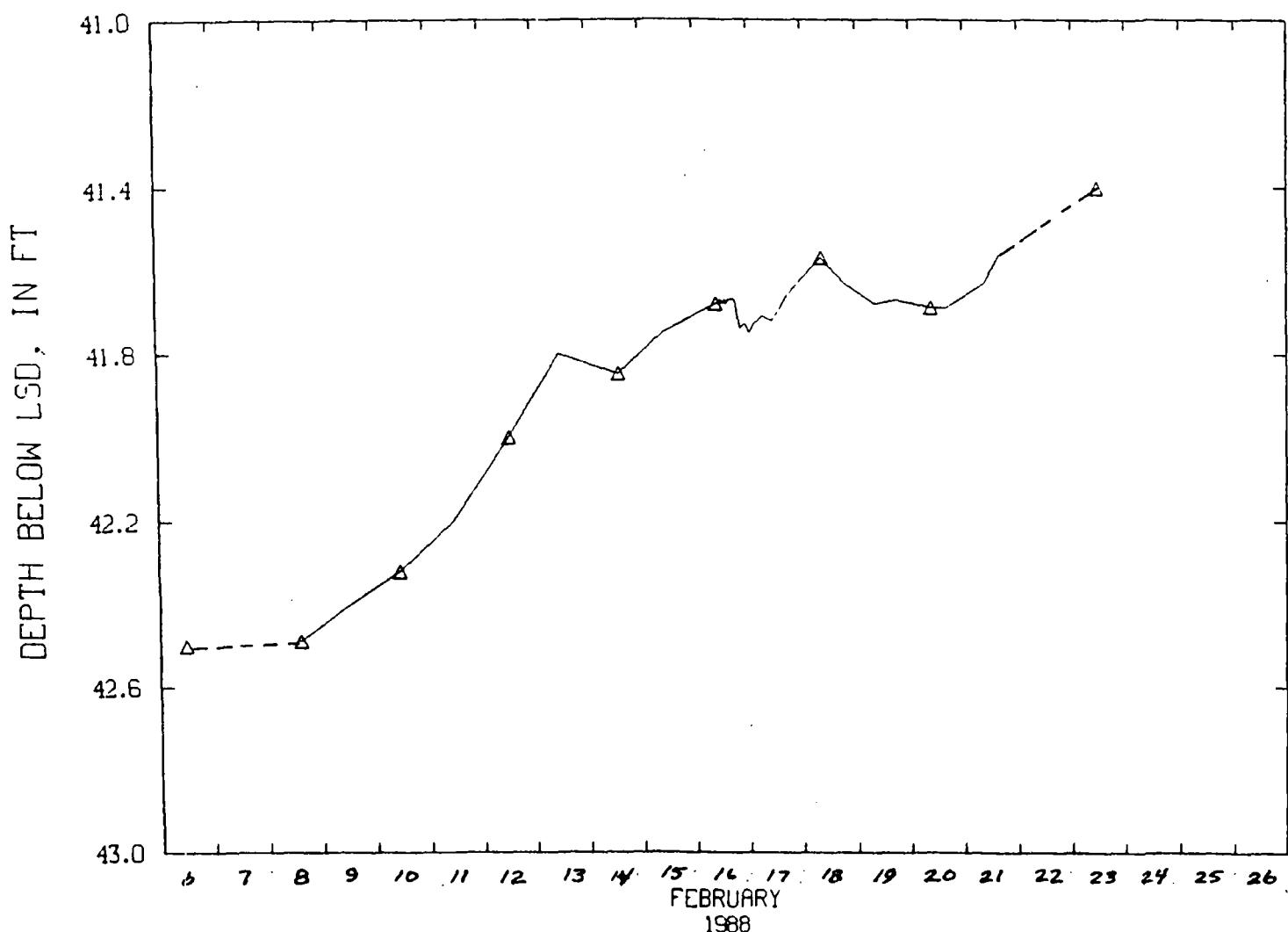
403955111294201 PACIFIC BRIDGE WELL  
INSTANTANEOUS DEPTH BELOW LSD (FT), EDITED



404005111303801 PACIFIC BRIDGE WELL  
INVERSE OF AIR PRESSURE (FEET OF WATER)

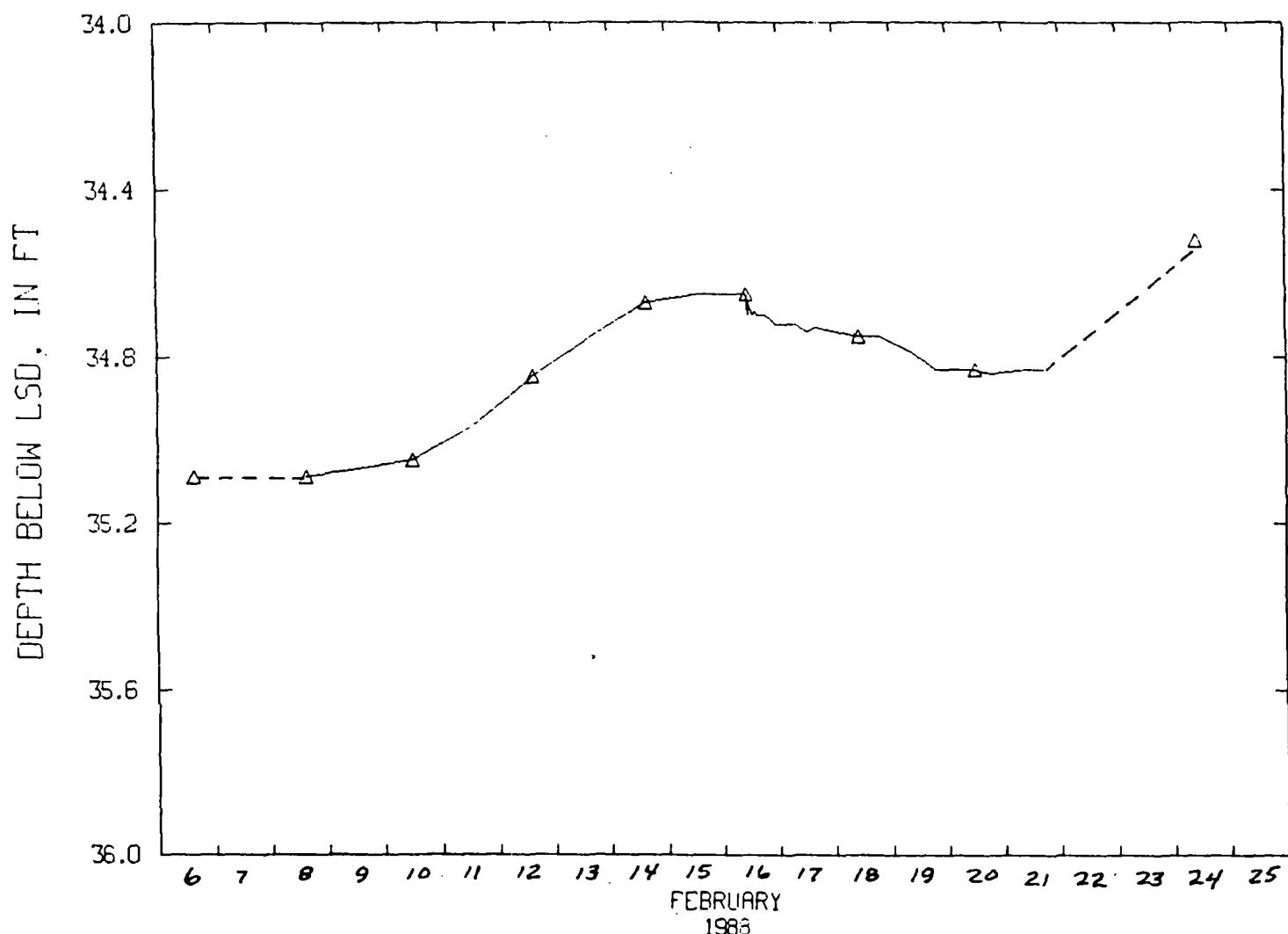
- △—△ 403955111294201 PACIFIC BRIDGE WELL  
INSTANTANEOUS DEPTH BELOW LSD (FT), EDITED
- 404005111303801 PACIFIC BRIDGE WELL  
INVERSE OF AIR PRESSURE (FEET OF WATER)

Figure 6.--Fluctuations during interference test (dashed where estimated)--Continued.



403942111300201 MW-12  
INSTANTANEOUS DEPTH BELOW LSD (FT), EDITED

Figure 6.--Fluctuations during interference test (dashed where estimated)--Continued.



403958111294301 MW-2  
INSTANTANEOUS DEPTH BELOW LSD (FT), EDITED

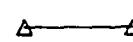
Figure 6.--Fluctuations during interference test (dashed where estimated)--Continued.

DEPTH BELOW LSD, IN FT

24.5  
24.9  
25.3  
25.7  
26.1  
26.5

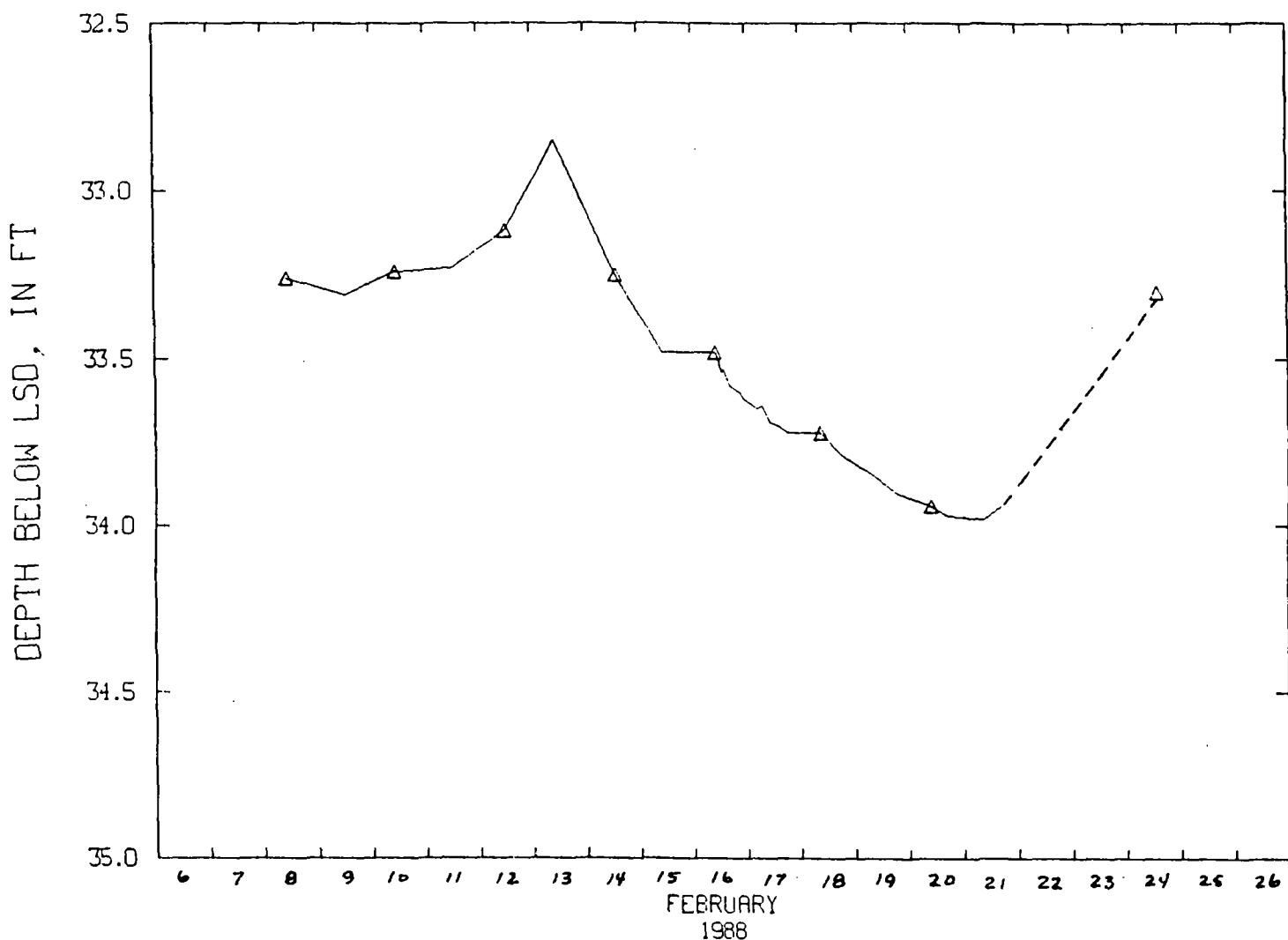
6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25

FEBRUARY  
1988



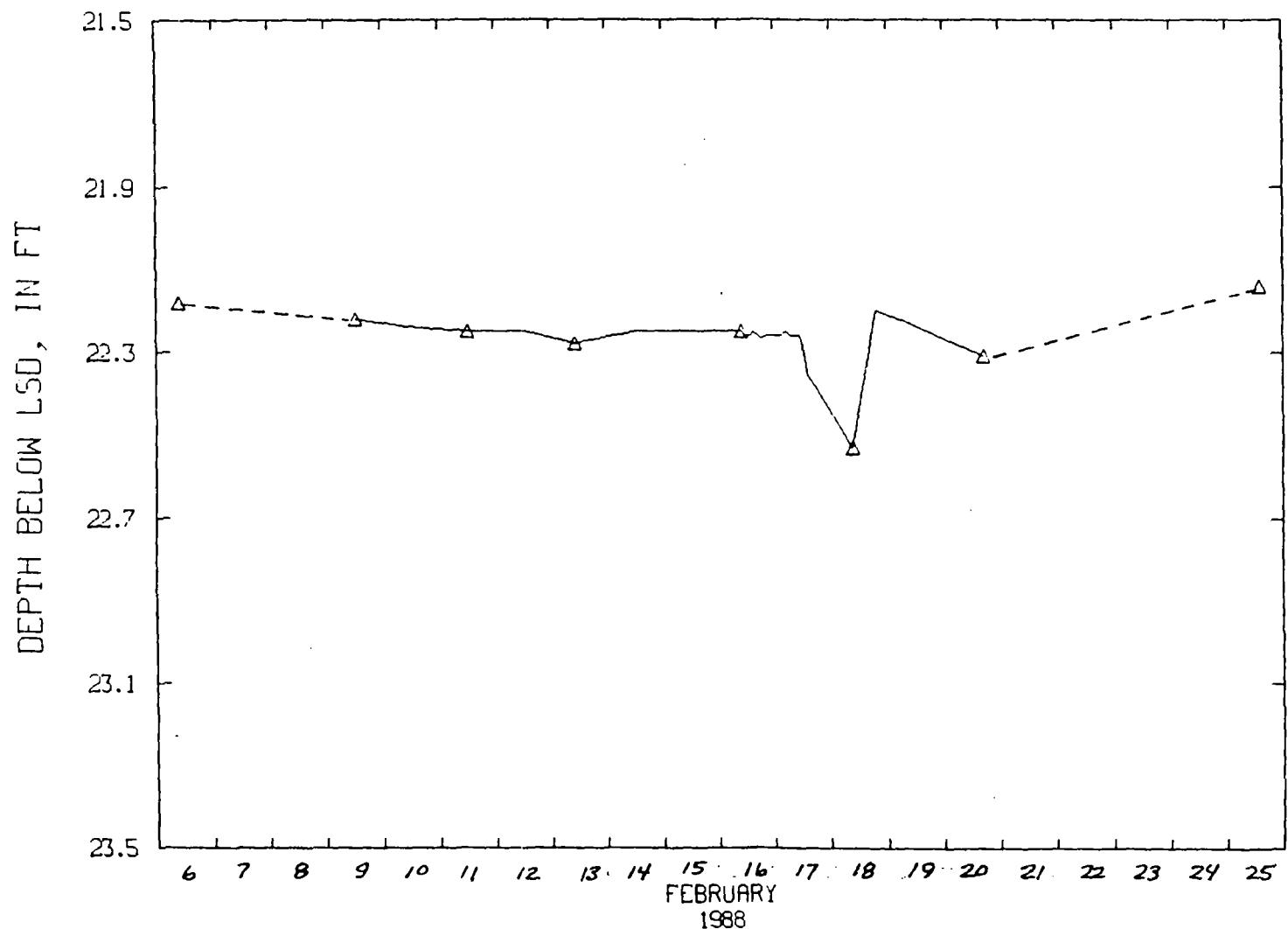
404001111294101 MW-3  
INSTANTANEOUS DEPTH BELOW LSD (FT), EDITED

Figure 6.--Fluctuations during interference test (dashed where estimated)--Continued.



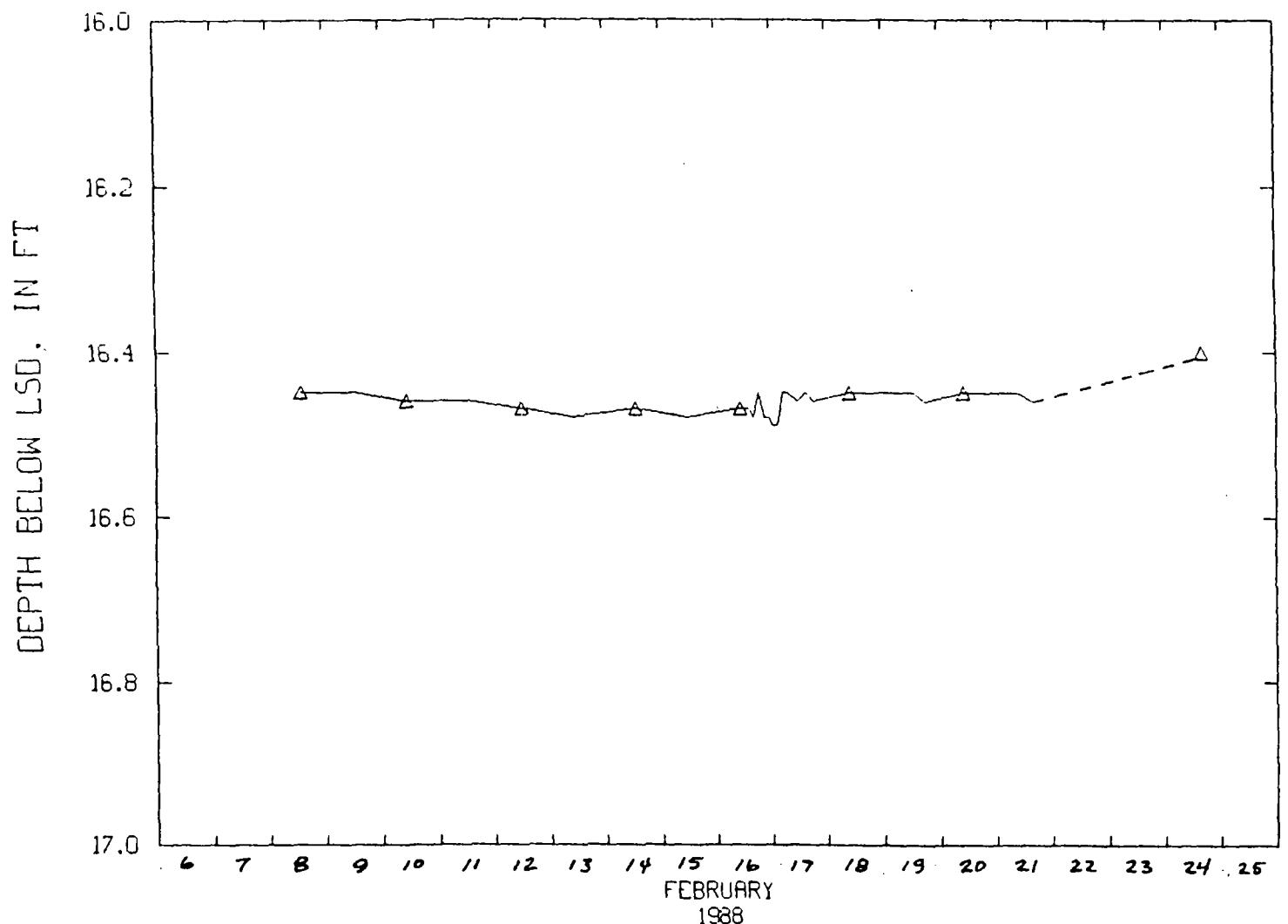
403945111294301 MW-4  
INSTANTANEOUS DEPTH BELOW LSD (FT), EDITED

Figure 6.--Fluctuations during interference test (dashed where estimated)--Continued.



40395111292701 MW-5  
INSTANTANEOUS DEPTH BELOW LSD (FT), EDITED

Figure 6.--Fluctuations during interference test (dashed where estimated)--Continued.



403959111292401 MW-6  
INSTANTANEOUS DEPTH BELOW LSD (FT), EDITED

Figure 6.--Fluctuations during interference test (dashed where estimated)--Continued.

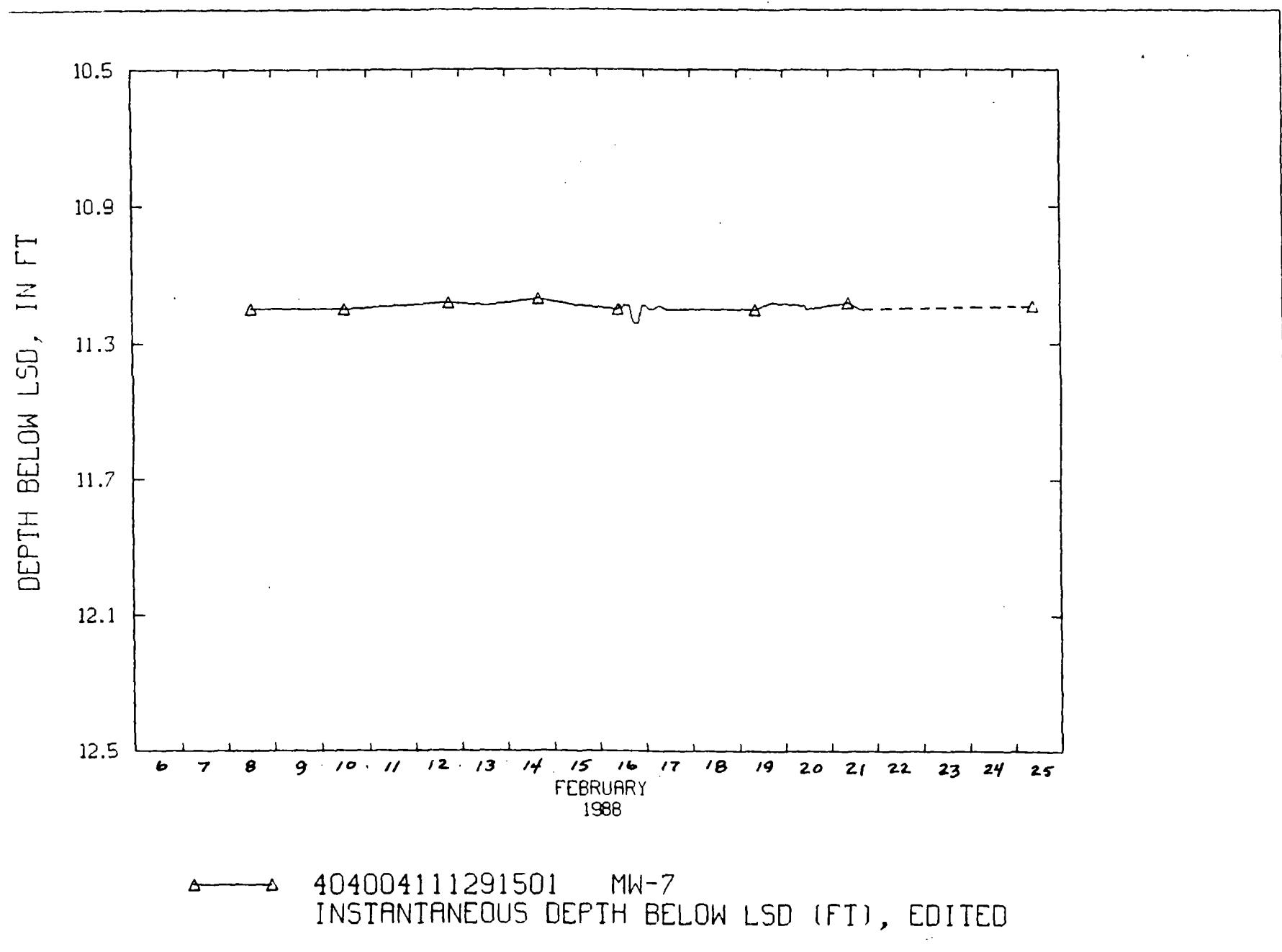
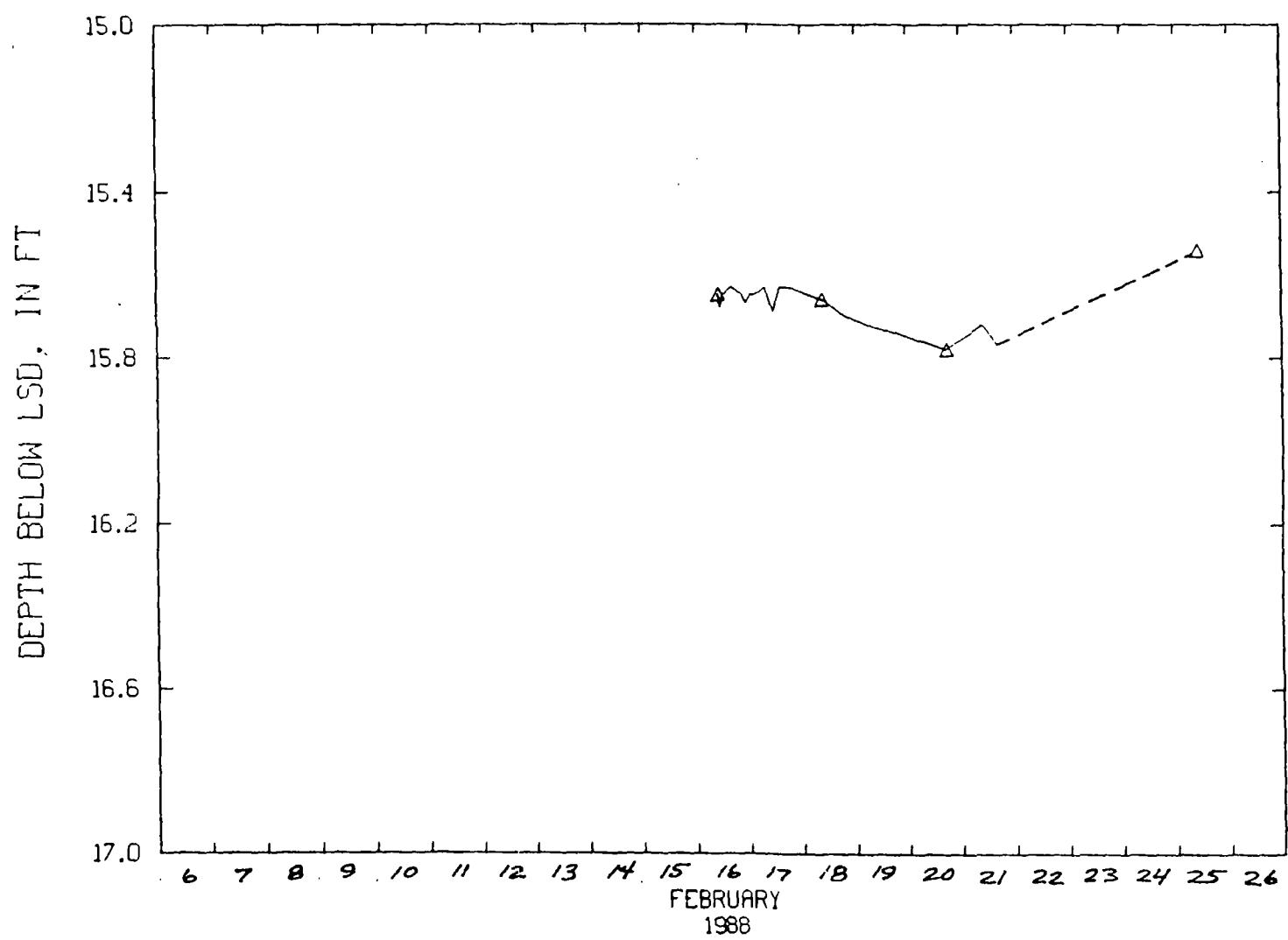
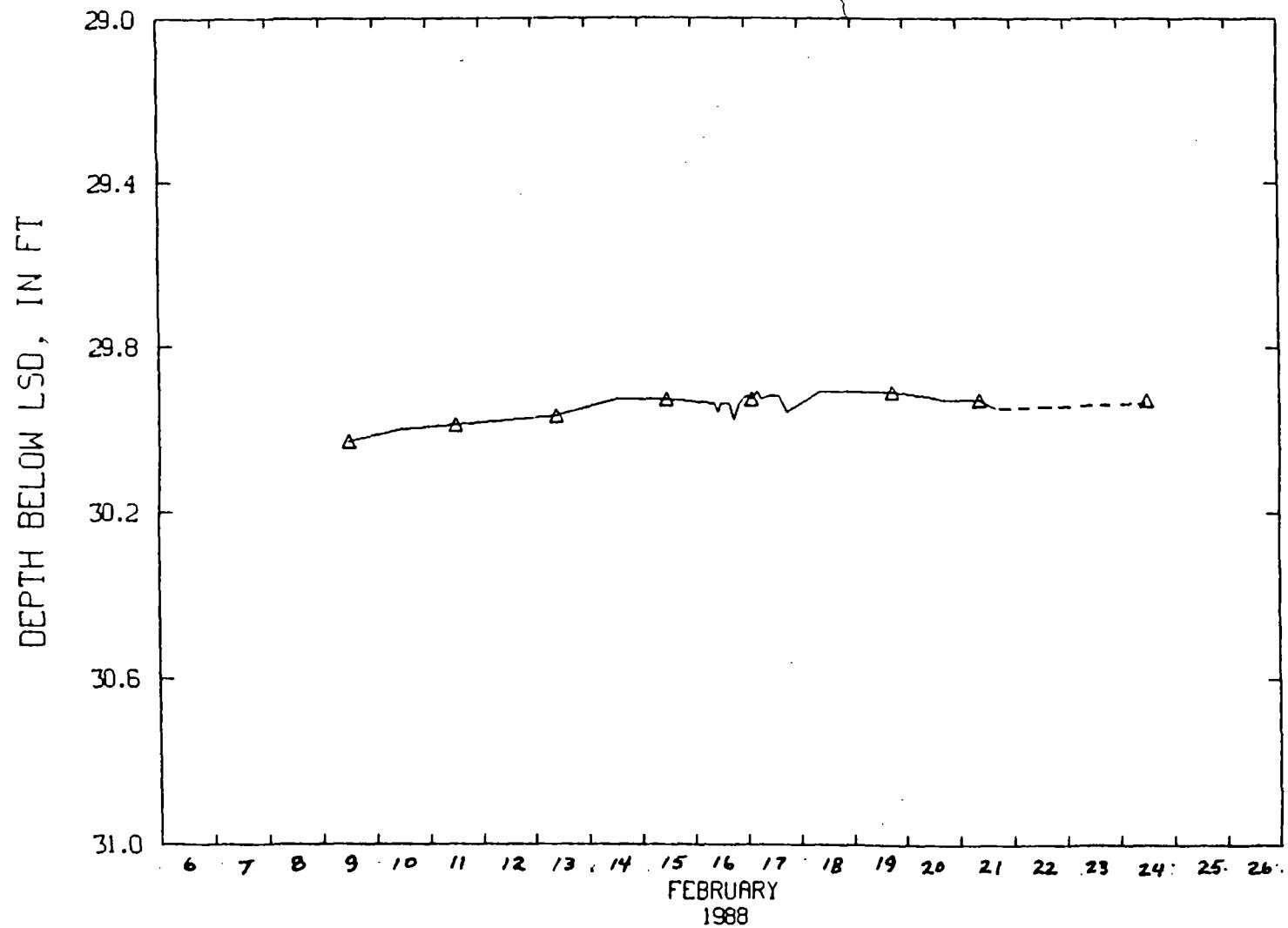


Figure 6.--Fluctuations during interference test (dashed where estimated)--Continued.



→ → 404004111291502 MW-7D  
INSTANTANEOUS DEPTH BELOW LSD (FT), EDITED

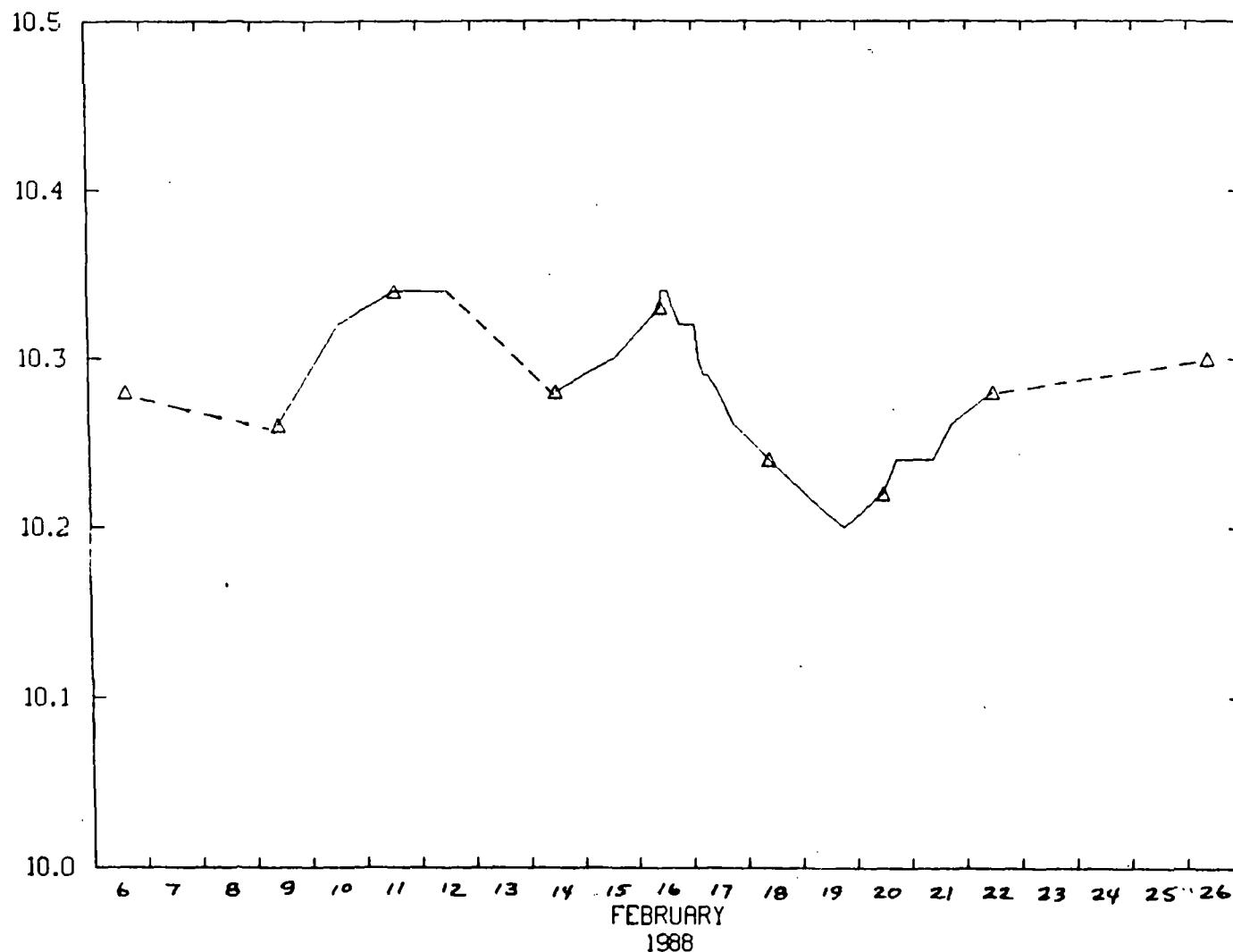
Figure 6.--Fluctuations during interference test (dashed where estimated)--Continued.



403954111293901 MW-8  
INSTANTANEOUS DEPTH BELOW LSD (FT), EDITED

Figure 6.--Fluctuations during interference test (dashed where estimated). Continued

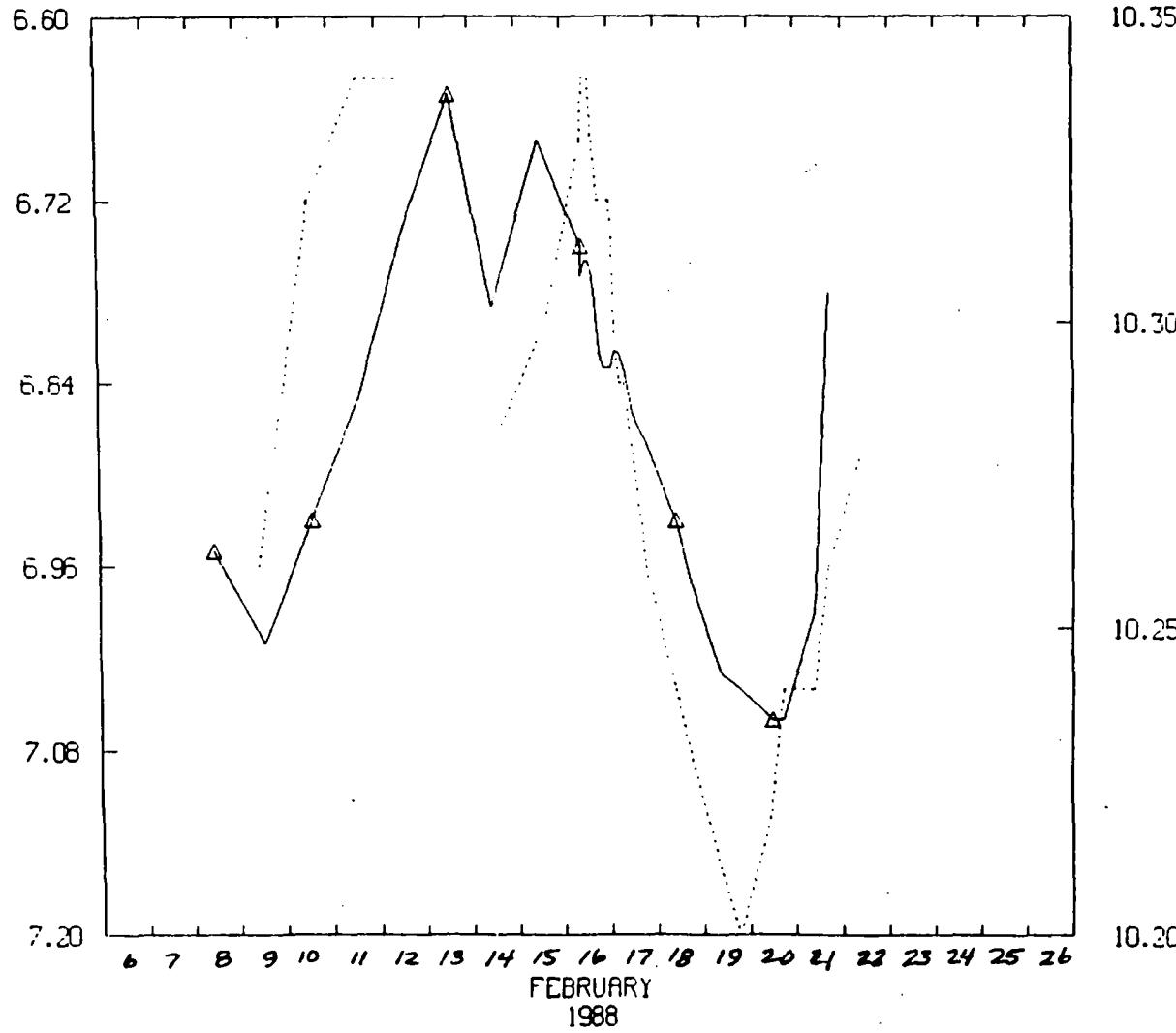
GAGE HEIGHT, IN FEET ABOVE DATUM



▲ 40401111291400 STAFF GAGE ON PACE-HOMER DITCH  
INSTANTANEOUS GAGE HEIGHT (FEET ABOVE DATUM), EDITED

Figure 6.--Fluctuations during interference test (dashed where estimated)--Continued.

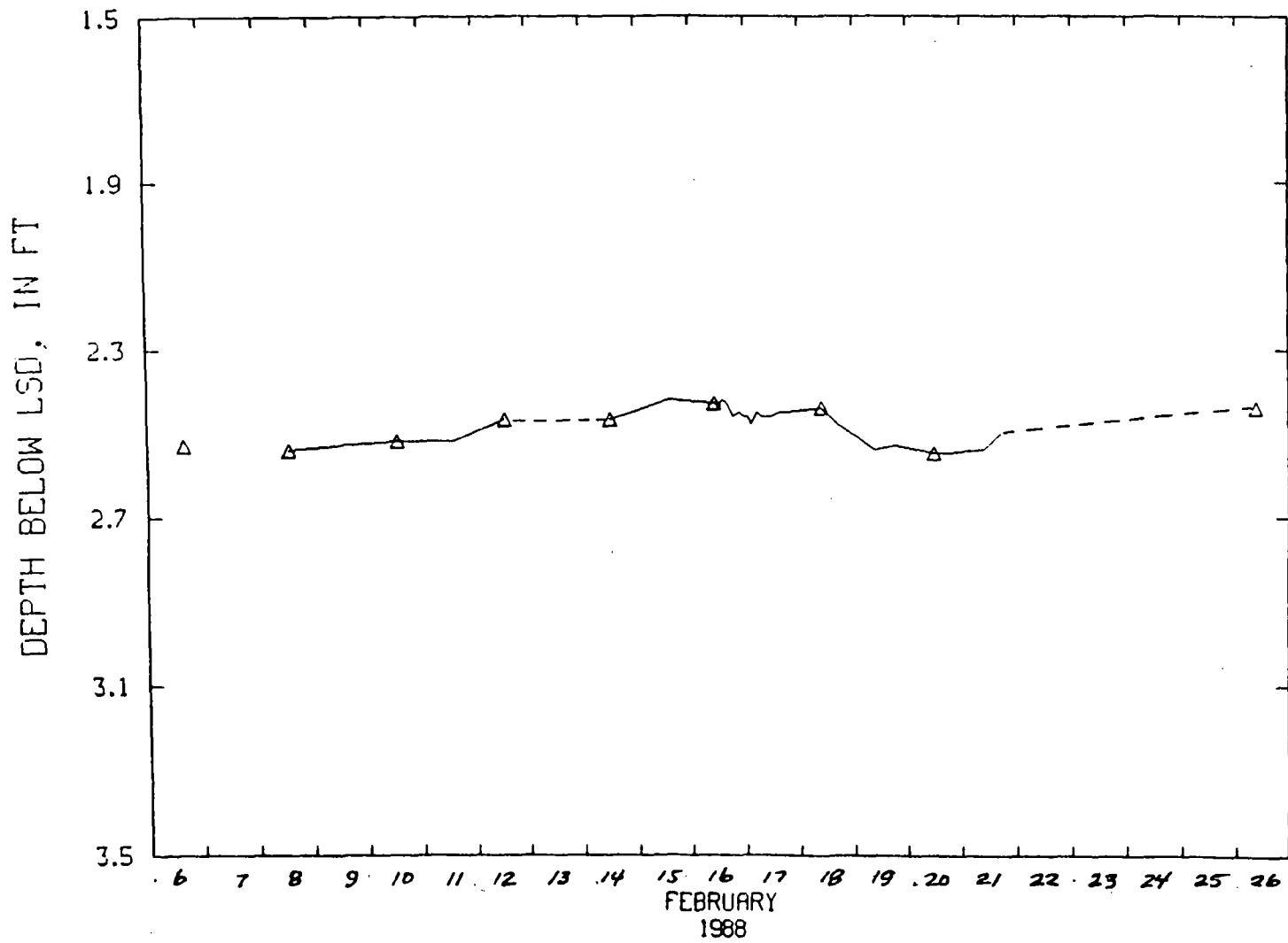
404005111290601 MW-9  
INSTANTANEOUS DEPTH BELOW LSD (FT), EDITED



404011111291400 STAFF GAGE ON PACE-HOMER DITCH  
INSTANTANEOUS GAGE HEIGHT (FEET ABOVE DATUM), EDITED

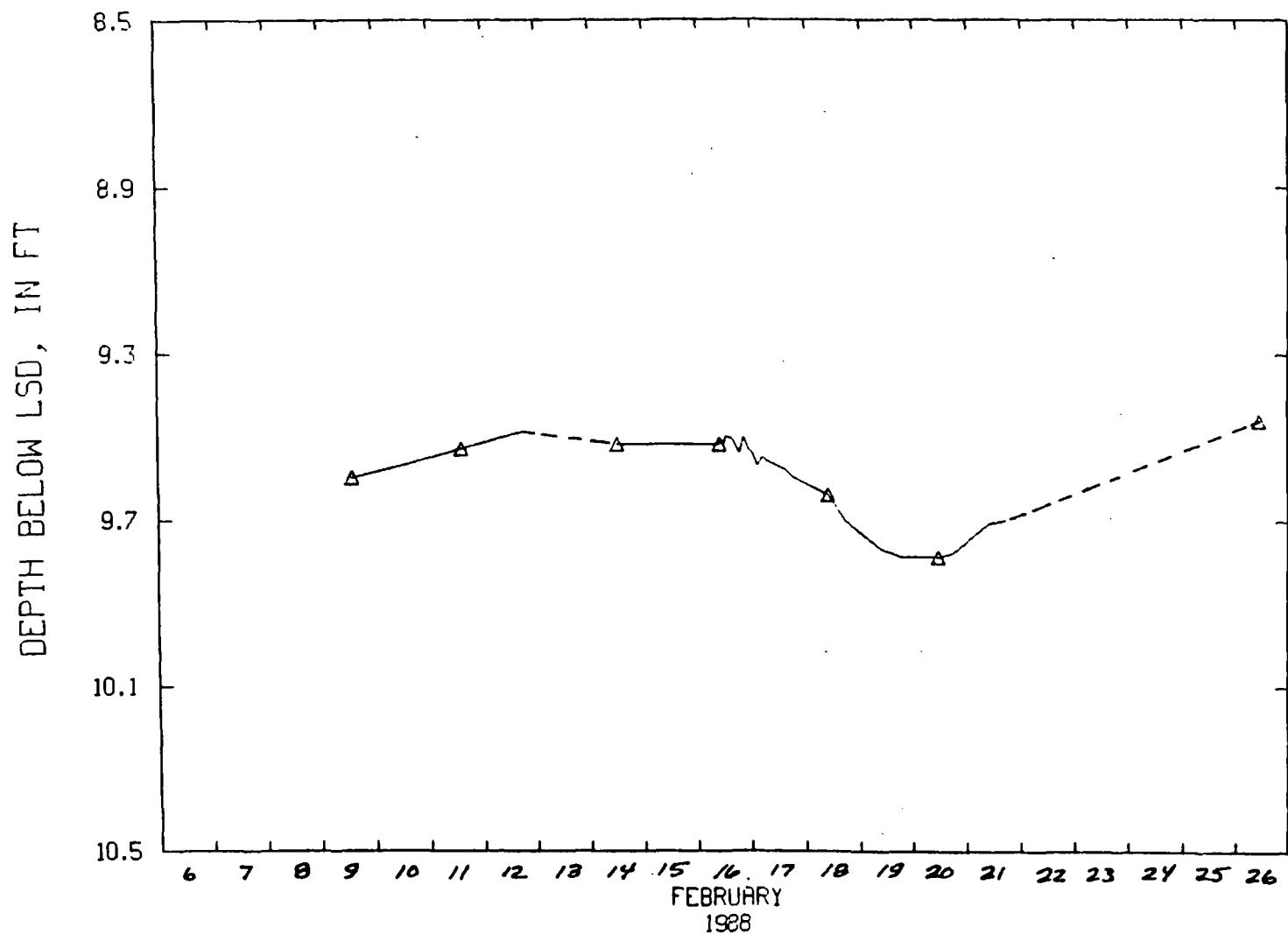
△ 404005111290601 MW-9  
INSTANTANEOUS DEPTH BELOW LSD (FT), EDITED  
..... 404011111291400 STAFF GAGE ON PACE-HOMER DITCH  
INSTANTANEOUS GAGE HEIGHT (FEET ABOVE DATUM), EDITED

Figure 6.--Fluctuations during interference test (dashed where estimated)--Continued.



404011111291501 MW-11  
INSTANTANEOUS DEPTH BELOW LSD (FT), EDITED

Figure 6.--Fluctuations during interference test (dashed where estimated)--Continued.



404008111291101 MW-11D  
INSTANTANEOUS DEPTH BELOW LSD (FT), EDITED

Figure 6.--Fluctuations during interference test (dashed where estimated)--Continued.

DISCHARGE, IN CUBIC FEET PER SECOND

3.0  
2.6  
2.2  
1.8  
1.4  
1.0

6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25

FEBRUARY  
1988

404007111285200 PACE-HOMER DITCH BL PROSPECTOR SQ NR PARK CITY, UT  
INSTANTANEOUS DISCHARGE (CFS), EDITED

Figure 6.--Fluctuations during interference test (dashed where estimated)--Continued.

ATTACHMENT F  
RESPONSE TO COMMENTS

# DAMES & MOORE

PROFESSIONAL LIMITED PARTNERSHIP

250 EAST BROADWAY, SUITE 200, SALT LAKE CITY, UTAH 84111-1480 (801) 521-9255

August 23, 1988

Park City Municipal Corporation  
P.O. Box 1480  
Park City, Utah 84060-1299

Attention: Mr. Ron Ivie

Dear Ron:

Attached are comments relating to the "Draft Groundwater and Surface Water Study Report, Silver Creek Tailing Site" August 1988 prepared by the Utah Department of Health and the U.S. Geological Survey. Two sets of comments are attached reflecting the independent evaluations of George Condrat and myself.

Very truly yours,

DAMES & MOORE



Peter F. Olsen  
Associate

PFO/f1

cc: Mr. Brent Bradford, UBSHW  
Ms. Paula Schmittdiel, EPA

RECEIVED

AUG 23 1988

Utah Dept. of Health  
Bureau of Solid Waste Management

COMMENTS ON  
DRAFT GROUNDWATER AND SURFACE WATER STUDY REPORT  
SILVER CREEK TAILINGS SITE  
AUGUST 1988

These comments deal exclusively with the water quality portion of the study. Overall, the report does a very poor job of presentation and analysis of the water quality data. It is extremely difficult to obtain an overview and make independent evaluations of the interpretations and conclusions reached. The map presented as Figure 2 is of such small scale and so crowded that it is very difficult to locate wells and surface water sampling points and correlate results with sites. The tailings area is not delineated on this map. The only map which provides reasonable locational data for the wells was hidden in an attachment and on it one of the upgradient wells is misidentified (2D should be 12).

The data is presented as a mass in Tables 6 and 7 for surface water sampling results and in a 5-page fine-print table (Table 9) for ground water. Such presentation defies visualization and understanding. Graphical presentations need to be included such as Piper diagrams for the common ions to show variations in basic water chemistry (by well and with time) and areal plots of the concentrations of key metals.

It is noted that "data which did not match closely with other labs was flagged with a star and was not included in the statistical evaluation." How was such a match determined - simply by subjective evaluation or was some objective criterion applied? There are many sets of data included in Table 9 which are not flagged which do not "closely match" each other.

During submittal of quarterly results of EPA's CLP analyses, the data was in standard CLP format which indicates any qualifiers for each value presented. This format was not utilized in the report and as a result there is no way to determine if qualified data, including that which is bracketed, i.e., below CRDL, was used in making statistical comparisons. From previous submittals, however, it is obvious that it was.

Quality Assurance of the data is, in essence, not addressed. Presentation of the CLP results in standard format along with narrative indicating problem areas would be sufficient for EPA's analyses. Something similar is necessary for the USGS and State Health Laboratory data in order to permit evaluation of the precision and accuracy of these results. To simply state that both conduct their own QA programs and that such documents are kept on file and may be obtained upon request, provides no assurance of the quality of the data.

One specific QA area that needs to be discussed has to do with the detection limits for the various metals. These vary significantly among the three labs and within any one agency's lab(s) from round to round. Does the fact that EPA's splits were analyzed by "various contract laboratories" have anything to do with varying capabilities, different methodologies or varying CRDLs of the different labs ?

In making the calculations for statistical comparisons, how were values below reported detection limits handled - by utilizing half the reported detection limit as the value ?

While the use of the combined data from the three upgradient wells as "background" is appropriate, the use of the (presumably) combined data from "all other wells" as a downgradient value does not seem to be, since some of these "others," such as wells 2, 4, 5, 6 and 8 are in the middle of the site, not at its downgradient boundary.

Statistical evaluations were made separately for the data generated by each of the agencies. Whether this meets the intent of the Site Investigation Agreement which states that all validated (i.e., unqualified in our interpretation) be used is not clear and needs to be resolved. Since several CLP labs conducted the EPA analyses, another option may be to utilize the combined measurements of all three agency labs (eliminating outliers by an objective method).

Attachment D (still labeled as Appendix F) is taken directly out of the UBSHW regulations document. This is not an appropriate attachment since it deals with RCRA requirements, notes the 0.01 confidence level as per the Part 265 regulations, then in the formulas and tabular values uses t-values associated with the 0.05 confidence level. We assume that the 0.05 level was used but perhaps the 0.01 level is more appropriate in this situation. Since the Site Investigation Agreement does not specify the statistical test to be employed, justification for the use of Cochran's approximation of the Behrens-Fisher Students t-test needs to be presented. Simply because it is the one required in certain portions of the RCRA regulations does not mean that it is the most appropriate to use in this situation. This needs to be resolved among the participants in the Site Investigation Agreement.

The individual values (along with any qualifications of the data) used for each statistical comparison need to be clearly identified in a separate table and pertinent data for the comparison summarized. A presentation such as that in Table 11 does not provide sufficient information.

The concentrations of metals detected in the wells should be placed in better quantitative perspective to primary and secondary drinking water standards. For example, the highest levels of zinc detected (2,000-3,000 ug/l) are well below the secondary drinking water standard of 5,000 ug/l.

The term "release" is continually used in the water quality sections. This needs to be examined closely.

Comments by  
Peter F. Olsen  
Dames & Moore  
August 22, 1988

1

COMMENTS ON  
DRAFT GROUNDWATER AND SURFACE WATER STUDY REPORT  
SILVER CREEK TAILINGS SITE  
AUGUST 1988

SECTION 3.1

1st Paragraph

There is no evidence of glaciation of the valley at Prospector Square.

4th Paragraph

What information is available regarding the use of solvents and acids at the site?

5th Paragraph

To say Park City has plans to cover the tailings could be taken as a deliberate suggestion that the City has not acted at the site.

SECTION 3.4.1.2

The water table surface map in Figure 4 shows conditions only during April 1988. Were variations in the flow direction noted during other times of the year.

SECTION 3.4.1.4

2nd Paragraph

Infiltration of snow-melt and down-valley flow of ground water through the alluvium are an important cause of the ground water rise.

SECTION 3.4.1.5

How poor is the slug data ? Is it reliable at all ? The report should include the basic data and should show the curve matches.

## SECTION 5.0

Is there aquifer interconnection between the alluvium under the Prospector Square site and Park Meadows well ? This was an important study objective.

## SECTION 8.1

How was the volume of tailings calculated (to 4 significant figures) ? Apparently tailings were identified in only three borings (see Appendix A) with a total thickness of 1.0, 5.3 and 1.6 feet, respectively. What is assumed areal extent and thickness ? Concentrations of chromium and manganese are within the range typically encountered in western soils.

## SECTION 8.2

### 2nd Paragraph

What is background ?

### 3rd Paragraph

What does significant mean ? This could be confused with statistically significant.

### 4th Paragraph

Well MW-10 is close to Silver Maple Claim and may be affected by that site. A more thorough evaluation of common ion chemistry may be more revealing than looking at trace metals. Sulfate is generally a good indicator of contamination from mineral deposits due to its generation by oxidation of sulfides. Report should contain Piper diagrams to aid evaluation of common ion chemistry. Concentration maps of sulfate, chloride and other constituents would also aid interpretation.

### SECTION 8.3

Only zinc showed to be consistently above background in ground waters downgradient of the site according to the report. The occasional findings of significant increases for arsenic, cadmium, chromium, and manganese, are often contradicted by data for other agencies taken at the same time or by subsequent sampling rounds. Data for trace metals are subject to large variations due to sampling and analytical variability and the occasional significant differences may be due solely to this. Zinc and other parameters show wide variations between splits of individual samples.

Questions - How were "less than" values handled in statistical comparisons ? Have evaluations been made to statistically identify individual wells and sample splits which are outliers indicating sampling or analytical error ?

#### 2nd Paragraph

"Another CERCLA site" - Is State suggesting Prospector Square is a CERCLA site ?

### SECTION 8.4

Variations of up to 50 times occur within splits of individual samples.

### SECTION 9.1

What is the meaning of "significant" in Item 2 ?

### SECTION 9.2

Item 1 - See comment on Section 8.3

Item 2 - The average cadmium concentration of 0.018 mg/l was barely over the drinking water standard of 0.010 mg/l.

Item 3 - Does not say whether interconnection occurs.

### SECTION 9.3

Item 1 - See comment in regard to Section 8.4

Item 2 - Cadmium exceeded the drinking water standard in one sample location (near Wyatt Earp Drive) in one sampling round only. Cadmium exceeded the standard in two of the three splits only, and only exceeded the standard by a small amount. The USGS split was over 5 times lower than the other splits values and was well below the standard. The stream location below the location near Wyatt Earp Drive met the standard for cadmium.

Tables 1 and 2 - An elevation of a clearly identifiable elevation datum (such as top of casing) should be reported for future monitoring. A surface elevation measure to 0.01 feet is very difficult to reconstruct unless there is a benchmark.

Well logs do not identify any tailings

Table 4 - Table should clearly identify what is being compared, should show population means and variances. Table should include evaluation of outliers, individual samples, and splits which are significantly different than the upgradient or downgradient populations.

Figures 1, 2, 4 and 6 - Should show north-arrows.

Figure 2 - Is difficult to read and at a rather small scale. Why not put it on a standard U.S.G.S. quadrangle map ?

Figure 5 - Should show months on x-axis and break between 1987 and 1988.

Plots should be on sample vertical scales and same horizontal scales.

Figure 6 - What is this supposed to show ?

Comments by  
George W. Condrat  
Dames & Moore  
August 22, 1988



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
REGION VIII  
999 18th STREET - SUITE 500  
DENVER, COLORADO 80202-2405  
SEP 1 1988

Ref: 8HWM-SR

Kent Gray  
Utah Department of Health  
P.O. Box 16690  
Salt Lake City, Utah 84116-0690

Dear Kent:

Enclosed are EPA's comments regarding the draft Ground Water and Surface Water Study Report for the Silver Creek Tailings site. Although the report is fairly complete, several issues should be addressed before finalizing the report. If you or your staff have any questions regarding our comments, please feel free to contact me at (303) 293-1518.

I am planning on the meeting the morning of September 8th with the State and Park City to go over the comments to the report. Please let me know if plans for the meeting change.

Sincerely,

*Paul Schmittdeil for*  
David A. Schaller, Chief  
Site Evaluation Section

Enclosure

RECEIVED

SEP 6 1988

EPA COMMENTS ON  
DRAFT GROUND WATER AND SURFACE WATER STUDY REPORT  
SILVER CREEK TAILINGS SITE

GENERAL

1. The term "significant" is used throughout the report in a variety of contexts, some statistical and some not. Clarification is needed as to how the term is being used in the report, since the term has a specific meaning with reference to environmental impacts.
2. The report should include a detailed discussion of target populations for each pathway, including number of wells and their uses and zones of completion as well as surface water uses and points of diversion.
3. In several portions of the report, additional discussion is needed to explain what was done and how. The discussions in many instances are too general and do not allow the reader to reach the same conclusions. Specific examples of insufficient information and discussion are identified in the rest of the comments.

GROUNDWATER

4. Section 3.4.1.5, Slug Test: The model that was used for analyzing the slug test as stated in the report is for confined isotropic conditions. In the first paragraph it stated that the alluvial aquifer is an anisotropic, unconfined aquifer. More explanation is needed as to why the methods used to determine hydraulic conductivities were considered appropriate when the assumptions of the methods can not be met. The Hrsorlev basic time lag method for approximating soil permeability is widely used for alluvial conditions that are heterogenous and unconfined in nature.

5. Section 5.0, Interfernce Test: Page 12, second paragraph, line 7 - the depth of 96 feet should be changed to 95 feet to match Table 1 in the well log for PS-MW-5D in Attachment A.

Page 13 - the statement that small fluctuations in wells PS-MW-1S, PS-MW-1D, PS-MW-2, PS-MW-3, PS-MW-4, PS-MW-7D and PS-MW-11D may have been due to pumping of the Park Meadows well does not appear to be substantiated by the hydrographs included in the report. The statement referring to the influence of the Park Meadows well and to recharge and surface runoff needs further explanation.

6. Section 8.2, Groundwater Data, Page 15, 2nd Paragraph: The discussion is unclear. Perhaps a sentence or phrase is missing.

7. More information is needed in Section 8.2 as to how upgradient and downgradient wells were determined. What method was used to determine an upgradient/downgradient well.

#### TAILINGS CHARACTERIZATION

8. Section 4.3.3.: No mention is made of the E.P. toxicity results of the subsurface soil cores collected of the tailings which indicate some of the samples meet the criteria of a hazardous waste. This information should be provided in the report and included in the findings. Also, a more detailed discussion should be included regarding the type of tailings and their extent found during drilling.

9. A discussion of the geochemical character of the tailings should be provided under section 8.1 on Waste Characterization, to help explain the results of the groundwater sampling effort. An understanding of the geo-chemical form of the tailings would support the presence or lack of particular elements in the groundwater.

#### SURFACE WATER

10. Section 8.4, Surface Water/Sediment Data: While Silver Creek sediment is heavily contaminated, the surface water release question still remains inconclusive, since the most upgradient sampling station is in the immediate vicinity of tailings. This was verified by the attempt to install a monitoring well at this location in November 1987. This effort encountered a significant thickness of tailings near the surface that have likely eroded into the creek as the sediment data shows. The furthest extent of contamination downstream is presently unknown.

11. Section 9.3, Surface Water: All comparisons in the report to background surface water or sediment are likely to underestimate releases. The conclusions should reflect this underestimate of releases to the surface water pathway.

#### DISCUSSION OF ANALYTICAL RESULTS

12. A more detailed discussion of the analytical results by well, parameter, and round is needed with comparisons of wells and rounds. Also, more extensive discussion of the statistical analyses conducted for the groundwater data should be provided, including why the Student T-test was selected and whether all the statistical assumptions were met with the data base. The discussion should also include the approach used to deal with outliers, etc.

13. More discussion is needed on the magnitude of the statistically significant releases that would help clarify the degree of metal releases from the tailings. An explanation as to

why well PS-MW-10 was not included in the statistical analyses is also needed.

14. An explanation as to why statistical analyses were not done on the surface water data should be given. Again, the discussion on the analytical results for the surface water and sediment samples is fairly general; more detail is needed.

QUALITY ASSURANCE

15. A more detailed discussion of the quality assurance procedures followed and the results of the quality assurance reviews for each set of data from each lab (EPA, USGS, and UDH) should be included in the report, i.e. spike recoveries, duplicates, blind samples, etc.

**DRAFT**  
**FOR DISCUSSION ONLY**

Silver Creek Tailings Site  
Groundwater/Surface Water Study Report

Response to Comments  
By Peter F. Olsen

Page 1, first paragraph:

Enclosed will be a revised Figure 2 which shows sample locations more clearly. FIT has designated MW-12 as MW2D for their records.

Page 1 second paragraph:

Enclosed are the revised Tables 6,7 and 9.

Page 1, third paragraph:

The date were flagged by subjective evaluation. Most if not all data, which did not match closely, have been flagged.

Page 1, fourth paragraph:

All the qualified data are usable unless rejected. Data from all rounds of sampling (with appropriate qualifiers) will be included in a separate attachment to the report.

Page 2, first paragraph:

The following steps were taken regarding the data quality assurance:

1. A detailed sampling plan (with input and consent from all parties) was prepared and followed during the field activities.
2. U.S. EPA Region VIII, Environmental Services Division conducted field audit and concluded that data gathered during this investigation should be valid and defensible.
3. Adequate number of field blanks, decommissioning blanks and duplicate samples were collected for each round of sampling. After the first round of groundwater sampling, performance evaluation (spike) samples were submitted to the labs with each set of samples. Analytical results of these quality control samples indicate that each lab's performance was adequate with the exception of cadmium results from the State Health Lab.
4. All CLP data were evaluated according to the EPA's functional guidelines for data validation and deemed acceptable. Data validation summaries will be included in an attachment to the report. State Health Lab is willing to

provide percision and accuracy data for each round of sampling. We will request USGS Lab to do the same. Percision and accuracy data will also be included in an attachment.

Page 2, second paragraph:

The detection limits depend upon various factors such as sample matrix, analytical method, lab proficiency and instrument used. Each analytical method has a range for detection limit and the CLP contract specifies required detection limit called (CRDL). These detection limits are above the instrument detection limit. The defference between the instrument detection limit and the method or contract detection limit provides opportunity for various labs to lower their reporting detection limit. This results in detection limits variability reported by different labs.

Page 2, third paragraph:

We intended to drop less than values from statistical calculations but due to the small sample size these values were used as such.

Page 2, fourth paragraph:

The wells which are hydraulically upgradient of the tailings area were designated as upgradient. The wells which are located on the tailings area can potentially be influenced by the tailings and were designated as the downgradient wells.

Page 2, last paragraph and page 3:

The criteria to determine a release under superfund process does not involve use of any statistics. It simply compares the downgradient contaminants levels against the upgradient ones. During the work plan negotiations references were made to RCRA requirements for statistical evaluation. This was the rationale for using the student t-test specified under RCRA.

Only validated date (which includes qualified data) was used. Each round of sampling was compared for each lab separately. Combining the results from different labs would increase the data variability.

The following data were not used in statistical evaluation:

1. Data collected from MW-10
2. Data collected from DR1 and DR2
3. Incomplete data set for a rounding a sampling (collected USGS occasionally)
4. Data flagged with a star (\*) .

**DRAFT**  
**FOR DISCUSSION ONLY**

Response Comments  
By George W. Condrat

Section 3.1, first paragraph:

If there is no evidence of glaciation of the valley, this word can be deleted.

Section 3.1, fourth paragraph:

We have documentation in our files that Pacific Bridge company reworked the tailings on-site using acids and solvents in 1940's.

Section 3.1, fifth paragraph:

Park City has covered most of the tailings. It is stated that Park City is planning to cover remaining exposed tailings area.

Sections 3.4.1.2, 3.4.1.4, 3.4.1.5:

Referred to USGS

Section 8.1

FIT calculated the volume of tailings based upon average thickness of tailings as five (5) feet in the 45 acres Prospector Square area.

Section 8.2, second paragraph:

Monitoring wells 1s, and 1d and 12 represent background wells for this site.

Section 8.2, third paragraph:

Significant means higher than background.

Section 8.2, fourth paragraph:

MW-10 is located downgradient of Prospector Square and is impacted by this site. Sulfate chloride and other anion provide useful information, the constituents of concern in this study are metals.

Section 8.3:

As stated earlier less than values were used as such in statistical evaluation. The date appear to match fairly well except for the data flagged as Star(\*) and not used for statistical evaluation.

Section 8.3, second paragraph:

Yes, Prospector Square is a CERCLA site but not an NPL site.

**DRAFT**  
**FOR DISCUSSION ONLY**

Section 8.4:

Data presented as provided by each lab.

Section 9.1:

Significant means higher than average soil values found in the Western U.S.

Section 9.2:

Item 1 - Response in Section 8.3.

Item 2 - No response is required.

Item 3 - Referred to USGS.

Section 9.3:

Item 1 - Response in Section 8.4.

Item 2 - Both filtered and unfiltered sample results should be reviewed in drawing conclusion.

Talbes 1, 2 and 4 - Referred to USGS.

Figures 1,2, 4, and 6 - Will show north arrows

Figure 2 and 5 - Referred to USGS.

Figure 6 - Shows site location on a USGS map.

MS/clq  
BSHW/7169U/1-4

**DRAFT**  
**FOR DISCUSSION ONLY**

**Response Comments**  
By George W. Condrat

Section 3.1, first paragraph:

If there is no evidence of glaciation of the valley, this word can be deleted.

Section 3.1, fourth paragraph:

We have documentation in our files that Pacific Bridge company reworked the tailings on-site using acids and solvents in 1940's.

Section 3.1, fifth paragraph:

Park City has covered most of the tailings. It is stated that Park City is planning to cover remaining exposed tailings area.

Sections 3.4.1.2, 3.4.1.4, 3.4.1.5:

Referred to USGS

Section 8.1

FIT calculated the volume of tailings based upon average thickness of tailings as five (5) feet in the 45 acres Prospector Square area.

Section 8.2, second paragraph:

Monitoring wells 1s, and 1d and 12 represent background wells for this site.

Section 8.2, third paragraph:

Significant means higher than background.

Section 8.2, fourth paragraph:

MW-10 is located downgradient of Prospector Square and is impacted by this site. Sulfate chloride and other anion provide useful information, the constituents of concern in this study are metals.

Section 8.3:

As stated earlier less than values were used as such in statistical evaluation. The date appear to match fairly well except for the data flagged as Star(\*) and not used for statistical evaluation.

Section 8.3, second paragraph:

Yes, Prospector Square is a CERCLA site but not an NPL site.

**DRAFT**  
**FOR DISCUSSION ONLY**

Section 8.4:

Data presented as provided by each lab.

Section 9.1:

Significant means higher than average soil values found in the Western U.S.

Section 9.2:

Item 1 - Response in Section 8.3.

Item 2 - No response is required.

Item 3 - Referred to USGS.

Section 9.3:

Item 1 - Response in Section 8.4.

Item 2 - Both filtered and unfiltered sample results should be reviewed in drawing conclusion.

Tables 1, 2 and 4 - Referred to USGS.

Figures 1, 2, 4, and 6 - Will show north arrows

Figure 2 and 5 - Referred to USGS.

Figure 6 - Shows site location on a USGS map.

MS/c1q  
BSHW/7169U/1-4

RESPONSE TO COMMENTS  
BY U.S. ENVIRONMENTAL PROTECTION AGENCY

**GENERAL:**

1. The term significant has been changed or deleted from the text of the report to avoid confusion.
2. Discussion of target population for surface and groundwater pathways has been added to the report.
3. Additional discussion and clarification has been added to the report where applicable.

**GROUNDWATER:**

4. The slug test data were analyzed using methods described by Bouwer and (1976) and Cooper and others (1967). The solution described by Bouwer and Rice (1976), which was developed for unconfined condition is based on the assumption that the aquifer is isotropic, the solution omits storage in the aquifer, and treats the water table as a fixed, constant-head boundary. The solution described by Cooper and others (1967) is based on the assumption that aquifer is confined, isotropic and not leaky.

The conditions to which above models are applicable exist in the study area.

5. Interference Test: The suggested correction has been made in the text.
- Page 13 - there are insufficient data to identify specific causes and offer further explanation.
6. Text has been revised to clarify the discussion.
7. Monitoring wells (1S, 1D and 12) which are hydraulically upgradient from the site are designated as upgradient wells. All other wells which are on-site and can be impacted from the tailings are designated as downgradient wells.

**TAILINGS CHARACTERIZATION:**

8. E.P. Toxicity analyses were not done as part of the approved work plan. These analyses were conducted to determine the proper disposal drilling/mud-cuttings. However, E.P. Toxicity analysis is included in attachment G.
9. It is nor clear what is meant by this comment.

**SURFACE WATER:**

10. During the drilling of monitoring well at this location very little tailings were encountered. This was confined by Jim Mason of U.S. Geological Survey. It is difficult to establish a background location in an area where tailings are ubiquitously present.

11. Same response as states above in #10.

DISCUSSION OF ANALYTICAL RESULTS:

12. A discussion of analytical results for each round is provided. However, it is difficult to discuss each monitoring well separately. Analytical results for each well are included in Table 9. Rationale for selection of T-test has been added to the report.
13. MW-10 was not included in the statistical analysis because it is located on Silver Maples Claim property (another CERCLA site).
14. Statistical analysis was not done on the surface water results due to insufficient data. The sample size is too small for statistical evaluation.

QUALITY ASSURANCE:

15. Discussion on quality assurance has now been included in the report.

MS/clq  
7339U-1 thru 2

ATTACHMENT G  
E. P. TOXICITY DATA

TABLE 1

TAILINGS CHARACTERIZATION SAMPLES  
 SUBSURFACE SOILS (ug/l)  
 EP TOXICITY LEACHING TEST  
 PROSPECTOR SQUARE  
 PARK CITY, UTAH

SAMPLE NUMBER	PS-MW-3	PS-MW-4	PS-MW-5	PS-MW-5	PS-MW-5	PS-MW-5
TRAFFIC NUMBER	MHH-057	MHH-058	MHH-053	MHH-054	MHH-055	MHH-056
SAMPLE INTERVAL	1.0-2.0'	1.0-1.5'	1.0-1.5'	4.0-5.5'	5.5-7.0'	7.5-9.0'
Aluminum	[87]j	[56]j	[66]nj	[196]j	[89]j	[103]j
Antimony	34uj	34uj	34uj	34uj	34uj	34uj
Arsenic	10uj	1.2uj	10uj	10uj	10uj	10uj
Barium	[22]	360	[138]	[61]	[82]	[21]
Beryllium	1.5uj	1.5uj	1.5u	1.5uj	1.5uj	1.5uj
Cadmium	583j	29j	675j	675j	608j	1070j
Calcium	32,900	388,000	165,000	150,000	184,000	25,900
Chromium	3.1uj	3.1uj	3.1uj	3.1uj	3.1uj	3.1uj
Cobalt	6.8u	6.8u	6.8u	6.8u	6.8u	6.8u
Copper	327	2.1u	179j	158j	100j	324j
Iron	17uj	17uj	17uj	[92]j	17uj	17uj
Lead	5640	51j	2370	2170j	1790j	1890j
Magnesium	[1920]	7400	[2870]	[2280]	[2850]	[1960]
Manganese	2410j	292j	2510j	2240j	2530j	2550j
Mercury	0.2uj	0.2uj	0.2u	0.2uj	0.2uj	0.2uj
Nickel	24u	24u	24u	24u	24u	24u
Potassium	[2020]	[2380]j	[1740]j	[1800]j	[2090]j	[1440]j
Selenium	5.0uj	2.0uj	[3.0]j	2.0j	2.0uj	2.0uj
Silver	[6.3]j	2.2uj	[8.6]j	[8.1]j	[6.0]j	[9.5]j
Sodium	[769]	[3600]j	[322]j	[295]	[414]j	[311]j
Thallium	[4.8]r	10r	2.1r	2.1r	2.1r	2.1r
Vanadium	[13]	[12]	[7.7]	[6.6]	[6.6]	[11]
Zinc	85,900r	1160	63,400	61,800	504,000	84,500

[] - indicated concentration detected at less than contract required detection limits.

u - indicates - undetected at this concentration

uj - detection limit estimated because not all quality control criteria were met

j - estimated value; not all quality control criteria were met

r - rejected data

TABLE 1

TAILINGS CHARACTERIZATION SAMPLES  
SUBSURFACE SOILS  
EP TOXICITY LEACHING TEST (ug/l)  
PROSPECTOR SQUARE  
PARK CITY, UTAH

SAMPLE NUMBER	PS-MW-9	PS-MW-9	PS-MW-9	EP TOXI-	EPA HAZ-
TRAFFIC NUMBER	MHH-059	MHH-060	MHH-061	CITY	ARDOUS
SAMPLE INTERVAL	3.0-4.0'	1.5-2.0'	2.4-3.0'	STANDARD	NUMBER
Aluminum	[53]j	[27]uj	[99]j		
Antimony	[39]j	[34]uj	34uj		
Arsenic	10uj	1.2uj	10uj	5000	D0004
Barium	[161]	[69]	[83]	100,000	D0005
Beryllium	1.5uj	1.5uj	1.5uj		
Cadmium	277j	834j	643	1000	D0006
Calcium	204,000	410,000	167,000		
Chromium	3.1uj	3.1uj	3.1uj	5000	D0008
Cobalt	6.8u	6.8u	[14]		
Copper	232j	78j	230j		
Iron	17uj	17uj	17uj		
Lead	590j	1970j	1760j	5000	
Magnesium	[2770]	6240	[4460]		
Manganese	4450j	3100j	6500j		
Mercury	0.2uj	0.7j	0.2uj	200	D0009
Nickel	24u	24u	24u		
Potassium	[538]j	180uj	[712]j		
Selenium	2.0uj	5.0uj	2.0uj	1000	D0010
Silver	2.2uj	2.2uj	[2.4]uj	5000	D0011
Sodium	[1900]	[1220]j	[1090]		
Thallium	10r	10r	2.1r		
Vanadium	[4.9]	2.9u	[3.6]		
Zinc	14100	52,100r	44,000		

[ ] - indicated concentration detected at less than contract required detection limits.

u - indicates - undetected at this concentration

uj - detection limit estimated because not all quality control criteria were met

j - estimated value; not all quality control criteria were met

r - rejected data

TABLE 2  
 EP TOXICITY ANALYTICAL RESULTS, (ug/l)  
 SUBSURFACE BOREHOLE SAMPLES  
 PROSPECTOR SQUARE  
 PARK CITY, UT  
 CASE #3317H

SAMPLE NUMBER	BH-01	BH-01	BH-02	BH-02	BH-02
DEPTH	3.5'-4.0'	4.0'-5.5'	0.0'-2.0'	2.0'-4.0'	4.0'-5.0'
TRAFFIC NUMBER	MHH-092	MHH-093	MHH-091	MHH-094	MHH-095
Aluminum	78u	78u	78u	78u	78u
Antimony	50u	50u	50u	50u	96
Arsenic	10u	10u	10u	10u	10u
Barium	[108]	[164]	[27]	23u	23u
Beryllium	2u	2u	2u	2u	2u
Cadmium	251	178	792	904	1090
Calcium	19100	29600	661000	655000j	674000j
Chromium	22	9u	9u	9u	9u
Cobalt	20u	20u	[20]	20u	20u
Copper	9u	9u	53	221	578
Iron	113	43u	[43]	43u	43u
Lead	5.82 j	154 j	2910 j	2540 j	2440 j
Magnesium	[1970]	[3730]	[3360]	11300	7050
Manganese	169 j	379 j	3990 j	5900	7330
Mercury	0.2u	0.2u	1.3	2.5j	0.2j
Nickel	25u	25u	25u	68 j	25u
Potassium	[4550]	[4370]	[1210]	[1050]	[1170]
Selenium	5u	5u	5u	5u	25u
Silver	8u	8u	8u	8u	8u
Sodium	[4390]	[3820]	[2010]	7190	7390
Thallium	10u	10u	10u	10u	10u
Tin	38u	38u	38u	38u	38u
Vanadium	11u	11u	11u	11u	11u
Zinc	12900	10100	96500	102000	108000

[] - indicated concentration detected at less than contract required detection limits.  
 u - indicates - undetected at this concentration  
 uj - detection limit estimated because not all quality control criteria were met  
 j - estimated value; not all quality control criteria were met  
 r - rejected data

TABLE 3  
(SOLUBILITY CONSTANTS) PREDICTED ZINC  
CONCENTRATIONS (ug/l) VERSUS pH

log Kg	Zn <sup>Z+</sup> 11.2	ZnOH <sup>+</sup> 2.2	ZnCO <sub>3</sub> 7.95 <sup>3</sup>
pH 5.5	130,000	205,550	10,183
pH 6.5	10,980	72,172	315
pH 7.0	2,740	42,766	45

87/10/27 17:33

JBO Page

PARK CITY MW-1D  
BUREAU OF SOLID AND HAZAR  
DOUS WASTE

UTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: PARK CITY MW-1D  
Site ID: CW87123 Source: 00  
Cost Code: 365  
Lab Number: 8704589 Type: 40  
Sample Date: 87/08/03 Time: 12:35  
Tot. Cations:  
Tot. Anions:  
Grand Total:

Date of Review and QA Validation  
Inorganic Review: 87/10/27  
Organic Review:  
Radiochemistry Review: 87/10/27  
Microbiology Review:

Laboratory Analyses

T-Arsenic	47.0 ppm	T-Barium	110.0 ppm
T-Cadmium	6 ppm	T-Chromium	100.0 ppm
T-Copper	35.0 ppm	T-Iron	24000.0 ppm
T-Lead	110.0 ppm	T-Manganese	880.0 ppm
Mercury	0.089 ppm	T-Selenium	<30.0 ppm
T-Silver	<6.0 ppm	T-Zinc	160.0 ppm
Arsenic HW	NO ppm	Barium HW	NO ppm
Cadmium HW	NO ppm	Cr (HW)	NO ppm
Lead (HW)	NO ppm	Mercury HW	NO ppm
Se (HW)	NO ppm	Silver HW	NO ppm
% Solids	81.3		

Approved by:

 Owner

PROSPECTOR SQUARE  
M.SLAM BUREAU OF SOLID  
AND HAZARDOUS WASTE

E.P. TOXICITY  
+  
T.M.

MW-1

UTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report TAILINGS

Description: PROSPECTOR SQUARE  
Site ID: Source: 00  
Cost Code: 365  
Lab Number: 8704125 Type: 50  
Sample Date: 87/07/16 Time:  
Tot. Cations:  
Tot. Anions:  
Grand Total:

Date of Review and QA Validation  
Inorganic Review:  
Organic Review:  
Radiochemistry Review:  
Microbiology Review:

Laboratory Analyses

T-Arsenic	6.0 ppm	T-Barium	34.0 ppm
T-Cadmium	13 ppm	T-Chromium	50.0 ppm
T-Lead	110.0 ppm	T-Manganese	500.0 ppm
Mercury	<1.0 ppm	T-Silver	1.3 ppm
T-Zinc	250.0 ppm	Arsenic HW	<0.2 ppm
Barium HW	0.093 ppm	Cadmium HW	<0.05 ppm
Cr (HW)	<0.03 ppm	Lead (HW)	<0.2 ppm
Mercury HW	<0 ppm	Se (HW)	<0.2 ppm
Silver HW	0.01 ppm	% Solids	94.0

Approved by:

 Oman

PARK CITY MW-1  
M.SLAM BUREAU OF SOLID  
AND HAZARDOUS WASTE

## E.P. TOXICITY

T  
T.M.MW-1  
LIQUIDUTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: PARK CITY MW-1  
Site ID: CW87160 Source: 00  
Cost Code: 365  
Lab Number: 8704099 Type: 40  
Sample Date: 87/07/15 Time: 14:30  
Tot. Cations:  
Tot. Anions:  
Grand Total:

Date of Review and QA Validation  
Inorganic Review:  
Organic Review:  
Radiochemistry Review:  
Microbiology Review:

Laboratory Analyses

T-Arsenic	13.0 ppm	T-Barium	480.0 ppm
T-Cadmium	21 ppm	T-Chromium	115.0 ppm
T-Lead	170.0 ppm	T-Manganese	4800.0 ppm
Mercury	<2.0 ppm	T-Silver	5.0 ppm
T-Zinc	310.0 ppm	Arsenic HW	<0.2 ppm
Barium HW	0.57 ppm	Cadmium HW	<0.05 ppm
Cr (HW)	<0.03 ppm	Lead (HW)	<0.2 ppm
Mercury HW	<0 ppm	Se (HW)	<0.2 ppm
Silver HW	<0.01 ppm	%SOLIDS	8.2

Approved by:



87/07/17 12:57

JBO Page:

**RECEIVED**

JUL 20 1987

Utah Dept. of Health  
Bureau of Solid & Hazardous WastePROSPECTOR SQUARE MW-1  
M.SALM BUREAU OF SOLID  
AND HAZARDOUS WASTEMW-1  
TAILINGSUTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: PROSPECTOR SQUARE MW-1

Site ID: Source: 00

Cost Code: 365

Lab Number: 8704124 Type: 50

Date of Review and QA Validation

Sample Date: 87/07/16 Time:

Inorganic Review: 87/07/17

Tot. Cations:

Organic Review:

Tot. Anions: me/l Cations:

Radiochemistry Review: 87/07/17

Grand Total: me/l Anions:

Microbiology Review:

Laboratory Analyses

T-Arsenic	<10.0 ppm (2.2)	T-Barium	100.0 ppm (2.2)
T-Cadmium	17 ppm (1.3)	T-Chromium	73.0 ppm (1.5)
T-Lead	77.0 ppm (1.6)	T-Manganese	980.0 ppm (2.6)
Mercury	<1.0 ppm (1.1)	T-Silver	2.0 ppm (1.04)
T-Zinc	170.0 ppm (3.6)	% Solids	83.3

Approved by:

 ± 25%\*DRY WEIGHT BASIS  
\*\*AS RECEIVED BASIS

**RECEIVED**

SEP 01 1987

Bureau of Solid  
& Hazardous Waste

PARK CITY PS-SO-1D

Mw-1D  
TAILINGSUTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: PARK CITY PS-SO-1D  
Site ID: Source: 00  
Cost Code: 900  
Lab Number: 8704608 Type: 50  
Sample Date: 87/07/21 Time: 14:50  
Tot. Cations:  
Tot. Anions:  
Grand Total:

Date of Review and QA Validation  
Inorganic Review: 87/08/31  
Organic Review:  
Radiochemistry Review: 87/08/31  
Microbiology Review:

Laboratory Analyses

T-Arsenic	60.0 ppm	T-Barium	160.0 ppm
T-Cadmium	7 ppm	T-Chromium	60.0 ppm
T-Copper	50.0 ppm	T-Iron	21000.0 ppm
T-Lead	220.0 ppm	T-Manganese	640.0 ppm
Mercury	0.2 ppm	T-Selenium	<40.0 ppm
T-Silver	<7.0 ppm	T-Zinc	460.0 ppm
% Solids	71.4		

Rough  
Estimate

8704589

T-AS	47.000	T-Arsenic, ug/l
T-BA	110.00	T-Barium, mg/l
T-CD	6.000	T-Cadmium, ug/l
T-CR	100.00	T-Chromium, ug/l
T-CU	35.000	T-Copper, ug/l
T-FE	24000.	T-Iron, mg/l
T-PB	110.00	T-Lead, ug/l
T-MN	880.00	T-Manganese, ug/l
HG	.089	Mercury, ug/l
T-SE	<30.000	T-Selenium, ug/l
T-AG	< 6.000	T-Silver, ug/l
T-ZN	160.00	T-Zinc, ug/l
ASHW		Arsenic (HW), ppm
BAHW		Barium (HW), ppm
CDHW		Cadmium (HW), ppm
CRHW		Chromium (HW), ppm
PBHW		Lead (HW), ppm
HGHW		Mercury (HW), ppm
SEHW		Selenium (HW), ppm
AGHW		Silver (HW), ppm
	81.300	% Solids

## MWID TAILINGS

CW87123  
MWID

Rough  
Estimate

J. Oman

RECEIVED

SEP 01 1987

Bureau of Solid  
& Hazardous Waste

SILVER CREEK PS MW3 1'-2'  
SOLID AND HAZARDOUS WASTE

MW-3  
TAILINGS

UTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: SILVER CREEK PS MW3 1'-2'  
Site ID: CW87213 Source: 00  
Cost Code: 365  
Lab Number: 8704423 Type: 50  
Sample Date: 87/07/28 Time: 08:41  
Tot. Cations:  
Tot. Anions:  
Grand Total:

Date of Review and QA Validation  
Inorganic Review:  
Organic Review:  
Radiochemistry Review:  
Microbiology Review:

Laboratory Analyses

T-Arsenic	380.0 ppm	T-Barium	210.0 ppm
T-Cadmium	190 ppm	T-Chromium	57.0 ppm
T-Copper	710.0 ppm	T-Iron	22000.0 ppm
T-Lead	13000.0 ppm	T-Manganese	2000.0 ppm
Mercury	3.7 ppm	T-Selenium	<30.0 ppm
T-Silver	67.0 ppm	T-Zinc	23000.0 ppm
% Solids			

Approved by:

87/08/31 13:08

JBO Page

RECEIVED

SEP 01 1987

Bureau of Solid  
& Hazardous WasteSILVER CREEK PS MW3 1'-2'  
SOLID AND HAZARDOUS WASTEMW-3  
TAILINGSUTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

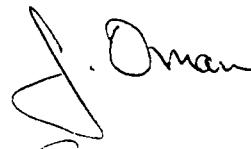
Description: SILVER CREEK PS MW3 1'-2'  
Site ID: CW87213 Source: 00  
Cost Code: 365  
Lab Number: 8704423 Type: 50  
Sample Date: 87/07/28 Time: 08:41  
Tot. Cations:  
Tot. Anions:  
Grand Total:

Date of Review and QA Validation  
Inorganic Review: 87/08/31  
Organic Review:  
Radiochemistry Review: 87/08/31  
Microbiology Review:

Laboratory Analyses

T-Arsenic	380.0 ppm	T-Barium	210.0 ppm
T-Cadmium	190 ppm	T-Chromium	57.0 ppm
T-Copper	710.0 ppm	T-Iron	22000.0 ppm
T-Lead	13000.0 ppm	T-Manganese	2000.0 ppm
Mercury	3.7 ppm	T-Selenium	<30.0 ppm
T-Silver	67.0 ppm	T-Zinc	23000.0 ppm
% Solids	91.7		

Approved by:

  
J. Oman  
Rough Estimate

PARK CITY MW-3  
BUREAU OF SOLID AND HAZAR  
DOUS WASTE

E.P. TOXICITY  
+  
T.M. MW-3  
LIQUID

UTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: PARK CITY MW-3  
Site ID: CW87120 Source: 00  
Cost Code: 365  
Lab Number: 8704586 Type: 40  
Sample Date: 87/07/29 Time: 12:30  
Tot. Cations:  
Tot. Anions: me/l Cations:  
Grand Total: me/l Anions:

Date of Review and QA Validation  
Inorganic Review:  
Organic Review:  
Radiochemistry Review:  
Microbiology Review:

Laboratory Analyses

T-Arsenic	<180.0 ppm	T-Barium	260.0 ppm
T-Cadmium	<40 ppm	T-Chromium	110.0 ppm
T-Copper	37.0 ppm	T-Iron	31000.0 ppm
T-Lead	150.0 ppm	T-Manganese	810.0 ppm
Mercury	0.1 ppm	T-Selenium	<180.0 ppm
T-Silver	<40.0 ppm	T-Zinc	410.0 ppm
Arsenic HW	<0.2 ppm	Barium HW	0.36 ppm
Cadmium HW	<0.05 ppm	Cr (HW)	<0.03 ppm
Lead (HW)	<0.2 ppm	Mercury HW	<0 ppm
Se (HW)	<0.2 ppm	Silver HW	<0.01 ppm
% Solids	6.0		

Approved by:

A. Oman

87/08/31 13:09

RECEIVED

SEP 01 1987

Bureau of Solid  
& Hazardous Waste

PARK CITY PS-SO-3A

MW -3  
TAILINGSUTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: PARK CITY PS-SO-3A  
Site ID: Source: 00  
Cost Code: 900  
Lab Number: 8704610 Type: 50  
Sample Date: 87/07/23 Time: 13:40  
Tot. Cations:  
Tot. Anions:  
Grand Total:

Date of Review and QA Validation  
Inorganic Review: 87/08/31  
Organic Review:  
Radiochemistry Review: 87/08/31  
Microbiology Review:

Laboratory Analyses

T-Arsenic	120.0 ppm	T-Barium	76.0 ppm
T-Cadmium	30 ppm	T-Chromium	40.0 ppm
T-Copper	160.0 ppm	T-Iron	25000.0 ppm
T-Lead	4800.0 ppm	T-Manganese	1000.0 ppm
Mercury	3.2 ppm	T-Selenium	<30.0 ppm
T-Silver	10.0 ppm	T-Zinc	5400.0 ppm
% Solids	82.3		

Rough  
Estimate

87/09/02 13:39

JBO Pag

**RECEIVED**

SEP 14 1987

SILVER CREEK MW-4  
BUREAU OF SOLID AND HAZAR-  
DOUS WASTEUtah Dept. of Health  
Bureau of Solid & Hazardous WasteMW-4  
TAILINGSUTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: SILVER CREEK MW-4  
Site ID: Source: 00  
Cost Code: 365  
Lab Number: 8704246 Type: 50  
Sample Date: 87/07/18 Time: 10:15  
Tot. Cations:  
Tot. Anions:  
Grand Total:

Date of Review and QA Validation  
Inorganic Review: 87/09/02  
Organic Review:  
Radiochemistry Review: 87/09/02  
Microbiology Review:

Laboratory Analyses

T-Arsenic	<45.0 ppm	T-Barium	110.0 ppm
T-Cadmium	<5 ppm	T-Chromium	27.0 ppm
T-Copper	35.0 ppm	T-Iron	17000.0 ppm
T-Lead	97.0 ppm	T-Manganese	280.0 ppm
Mercury	0.02 ppm	T-Selenium	<45.0 ppm
T-Silver	<9.0 ppm	T-Zinc	150.0 ppm
% Solids	94.0		

Approved by:

**RECEIVED**

SEP 01 1987

PARK CITY PS-SO-4A

Bureau of Solid  
& Hazardous WasteMW-4  
TAILINGSUTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: PARK CITY PS-SO-4A  
Site ID: Source: 00  
Cost Code: 900  
Lab Number: 8704609 Type: 50  
Sample Date: 87/07/23 Time: 17:15  
Tot. Cations:  
Tot. Anions: me/l Cations:  
Grand Total: me/l Anions:

Date of Review and QA Validation  
Inorganic Review: 87/08/31  
Organic Review:  
Radiochemistry Review: 87/08/31  
Microbiology Review:

Laboratory Analyses

T-Arsenic	320.0 ppm	T-Barium	160.0 ppm
T-Cadmium	67 ppm	T-Chromium	87.0 ppm
T-Copper	510.0 ppm	T-Iron	25000.0 ppm
T-Lead	5600.0 ppm	T-Manganese	2800.0 ppm
Mercury	4.1 ppm	T-Selenium	<25.0 ppm
T-Silver	40.0 ppm	T-Zinc	12000.0 ppm
% Solids	96.7		

Rough  
Estimate

**RECEIVED**

SEP 14 1987

SILVER CREEK MW-5 1-1.5  
BUREAU OF SOLID AND HAZAR-  
DOUS WASTEUtah Dept. of Health  
Bureau of Solid & Hazardous WasteMW-5  
TAILINGSUTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: SILVER CREEK MW-5 1-1.5  
Site ID: Source: 00  
Cost Code: 365  
Lab Number: 8704247 Type: 50  
Sample Date: 87/07/20 Time: 11:40  
Tot. Cations:  
Tot. Anions:  
Grand Total:

Date of Review and QA Validation  
Inorganic Review: 87/09/02  
Organic Review:  
Radiochemistry Review: 87/09/02  
Microbiology Review:

Laboratory Analyses

T-Arsenic	410.0 ppm	T-Barium	94.0 ppm
T-Cadmium	83 ppm	T-Chromium	36.0 ppm
T-Copper	680.0 ppm	T-Iron	20000.0 ppm
T-Lead	6800.0 ppm	T-Manganese	2100.0 ppm
Mercury	4.5 ppm	T-Selenium	<26.0 ppm
T-Silver	52.0 ppm	T-Zinc	16000.0 ppm
% Solids	95.2		

Approved by:

87/09/02 13:39

JBO Page

**RECEIVED**

SEP 14 1987

SILVER CREEK MW5 4-5  
BUREAU OF SOLID AND HAZAR-  
DOUS WASTEUtah Dept. of Health  
Bureau of Solid & Hazardous Waste

MW-5 (4-5 Ft)

TAILINGS

UTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: SILVER CREEK MW5 4-5  
Site ID: Source: 00  
Cost Code: 365  
Lab Number: 8704248 Type: 50  
Sample Date: 87/07/20 Time: 11:50  
Tot. Cations:  
Tot. Anions:  
Grand Total:

Date of Review and QA Validation  
Inorganic Review: 87/09/02  
Organic Review:  
Radiochemistry Review: 87/09/02  
Microbiology Review:

Laboratory Analyses

T-Arsenic	480.0 ppm	T-Barium	57.0 ppm
T-Cadmium	88 ppm	T-Chromium	31.0 ppm
T-Copper	570.0 ppm	T-Iron	17000.0 ppm
T-Lead	9300.0 ppm	T-Manganese	2400.0 ppm
Mercury	4.3 ppm	T-Selenium	<26.0 ppm
T-Silver	57.0 ppm	T-Zinc	17000.0 ppm
% Solids	91.6		

Approved by:

87/09/02 13:39

JBO Page

**RECEIVED**

SEP 14 1987

SILVER CREEK MW 5-5--7-5  
BUREAU OF SOLID AND HAZAR-  
DOUS WASTEUtah Dept. of Health  
Bureau of Solid & Hazardous WasteUTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

MW-S (S-75 FT)

TAILINGS

Description: SILVER CREEK MW 5-5--7-5

Site ID: Source: 00

Cost Code: 365

Lab Number: 8704249 Type: 50

Date of Review and QA Validation

Sample Date: 87/07/20 Time:

Inorganic Review: 87/09/02

Tot. Cations:

Organic Review:

Tot. Anions: me/l Cations:

Radiochemistry Review: 87/09/02

Grand Total: me/l Anions:

Microbiology Review:

Laboratory Analyses

T-Arsenic	380.0 ppm
T-Cadmium	92 ppm
T-Copper	540.0 ppm
T-Lead	7000.0 ppm
Mercury	2.3 ppm
T-Silver	59.0 ppm
% Solids	91.8

T-Barium	59.0 ppm
T-Chromium	32.0 ppm
T-Iron	22000.0 ppm
T-Manganese	1900.0 ppm
T-Selenium	<27.0 ppm
T-Zinc	15000.0 ppm

Approved by:

**RECEIVED**

SEP 14 1987

SILVER CREEK MW5 7-9  
BUREAU OF SOLID AND HAZARDOUS WASTE

Utah Dept. of Health  
Bureau of Solid & Hazardous Waste

MW-5 (7-9FT.)

TAILINGS

UTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: SILVER CREEK MW5 7-9  
Site ID: Source: 00  
Cost Code: 365  
Lab Number: 8704250 Type: 50  
Sample Date: 87/07/20 Time:  
Tot. Cations:  
Tot. Anions:  
Grand Total:

Date of Review and QA Validation  
Inorganic Review: 87/09/02  
Organic Review:  
Radiochemistry Review: 87/09/02  
Microbiology Review:

Laboratory Analyses

T-Arsenic	400.0 ppm	T-Barium	120.0 ppm
T-Cadmium	82 ppm	T-Chromium	33.0 ppm
T-Copper	660.0 ppm	T-Iron	16000.0 ppm
T-Lead	7700.0 ppm	T-Manganese	2100.0 ppm
Mercury	3.8 ppm	T-Selenium	<27.0 ppm
T-Silver	55.0 ppm	T-Zinc	15000.0 ppm
% Solids	91.0		

Approved by:

**RECEIVED**

SEP 01 1987

PARK CITY PS-SO-5A

Bureau of Solid  
& Hazardous WasteMW-5  
TAILINGSUTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: PARK CITY PS-SO-5A  
Site ID: Source: 00  
Cost Code: 900  
Lab Number: 8704612 Type: 50  
Sample Date: 87/07/24 Time: 14:50  
Tot. Cations:  
Tot. Anions:  
Grand Total:

Date of Review and QA Validation  
Inorganic Review: 87/08/31  
Organic Review:  
Radiochemistry Review: 87/08/31  
Microbiology Review:

Laboratory Analyses

T-Arsenic	210.0 ppm	T-Barium	75.0 ppm
T-Cadmium	40 ppm	T-Chromium	33.0 ppm
T-Copper	420.0 ppm	T-Iron	23000.0 ppm
T-Lead	4400.0 ppm	T-Manganese	1300.0 ppm
Mercury	5.1 ppm	T-Selenium	<30.0 ppm
T-Silver	27.0 ppm	T-Zinc	7000.0 ppm
% Solids	84.7		

Rough  
Estimate

PARK CITY PS-MW-6  
BUREAU OF SOLID AND HAZAR-  
DOUS WASTE

E.P. TOXICITY MW-6  
+ LIQUID  
T.M.

UTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: PARK CITY PS-MW-6  
Site ID: Source: 00  
Cost Code: 365  
Lab Number: 8704290 Type: 40  
Sample Date: 87/07/20 Time:  
Tot. Cations:  
Tot. Anions: me/l Cations:  
Grand Total: me/l Anions:

Date of Review and QA Validation  
Inorganic Review:  
Organic Review:  
Radiochemistry Review:  
Microbiology Review:

Laboratory Analyses

T-Arsenic	50.0 ppm	T-Barium	540.0 ppm
T-Cadmium	20 ppm	T-Chromium	110.0 ppm
T-Copper	61.0 ppm	T-Iron	32000.0 ppm
T-Lead	480.0 ppm	T-Manganese	1500.0 ppm
Mercury	4.0 ppm	T-Selenium	<50.0 ppm
T-Zinc	1500.0 ppm	Arsenic HW	<0.2 ppm
Barium HW	0.34 ppm	Cadmium HW	0.06 ppm
Cr (HW)	<0.03 ppm	Lead (HW)	<0.2 ppm
Mercury HW	<0 ppm	Se (HW)	<0.2 ppm
Silver HW	<0.01 ppm	% Solids	14.1

Approved by:

8/10/07 16:11

JBO Pag

PARK CITY PS-MW-7  
BUREAU OF SOLID AND HAZAR-  
DOUS WASTE

E.P. TOXICITY  
+  
T.M

MW-7  
LIQUID

UTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: PARK CITY PS-MW-7  
Site ID: Source: 00  
Cost Code: 365  
Lab Number: 8704288 Type: 40  
Sample Date: 8/10/20 Time:  
Tot. Cations:  
Tot. Anions:  
Grand Total:

Date of Review and QA Validation  
Inorganic Review:  
Organic Review:  
Radiochemistry Review:  
Microbiology Review:

Laboratory Analyses

T-Arsenic	<100.0 ppm	T-Barium	920.0 ppm
T-Cadmium	42 ppm	T-Chromium	190.0 ppm
T-Copper	210.0 ppm	T-Iron	46000.0 ppm
T-Lead	1900.0 ppm	T-Manganese	1700.0 ppm
Mercury	12.0 ppm	T-Selenium	<100.0 ppm
T-Zinc	2900.0 ppm	Arsenic HW	<0.2 ppm
Barium HW	0.22 ppm	Cadmium HW	0.08 ppm
Cr (HW)	<0.03 ppm	Lead (HW)	0.25 ppm
Mercury HW	0.002 ppm	Se (HW)	<0.2 ppm
Silver HW	<0.01 ppm	% Solids	5.9

Approved by:



PARK CITY PS-MW-7  
BUREAU OF SOLID AND HAZAR-  
DOUS WASTE

E. P. TOXICITY  
+  
T.M. MW-7  
LIQUID

UTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: PARK CITY PS-MW-7  
Site ID: Source: 00  
Cost Code: 365  
Lab Number: 8704289 Type: 40  
Sample Date: 87/07/20 Time:  
Tot. Cations:  
Tot. Anions:  
Grand Total:

Date of Review and QA Validation  
Inorganic Review:  
Organic Review:  
Radiochemistry Review:  
Microbiology Review:

Laboratory Analyses

T-Arsenic	130.0 ppm	T-Barium	800.0 ppm
T-Cadmium	32 ppm	T-Chromium	160.0 ppm
T-Copper	260.0 ppm	T-Iron	40000.0 ppm
T-Lead	2600.0 ppm	T-Manganese	1600.0 ppm
Mercury	6.6 ppm	T-Selenium	<80.0 ppm
T-Zinc	3700.0 ppm	Arsenic HW	<0.2 ppm
Barium HW	0.27 ppm	Cadmium HW	0.12 ppm
Cr (HW)	<0.03 ppm	Lead (HW)	0.48 ppm
Mercury HW	0.007 ppm	Se (HW)	<0.2 ppm
Silver HW	<0.01 ppm	% Solids	16.6

Approved by:



**RECEIVED**

SEP 01 1987

Bureau of Solid  
& Hazardous WastePARK CITY MW-8  
BUREAU OF SOLID AND HAZAR  
DOUS WASTEMW-8  
LIQUIDUTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: PARK CITY MW-8  
Site ID: CW87121 Source: 00  
Cost Code: 365  
Lab Number: 8704587 Type: 40  
Sample Date: 87/07/30 Time:  
Tot. Cations:  
Tot. Anions: me/l Cations:  
Grand Total: me/l Anions:

Date of Review and QA Validation  
Inorganic Review: 87/08/31  
Organic Review:  
Radiochemistry Review: 87/08/31  
Microbiology Review:

Laboratory Analyses

T-Arsenic	49.0 ppm	T-Barium	180.0 ppm
T-Cadmium	7 ppm	T-Chromium	70.0 ppm
T-Copper	28.0 ppm	T-Iron	23000.0 ppm
T-Lead	120.0 ppm	T-Manganese	920.0 ppm
Mercury	1.1 ppm	T-Selenium	<40.0 ppm
T-Silver	<7.0 ppm	T-Zinc	470.0 ppm
% Solids	28.2		

Approved by:

Rough Estimate

87/10/07 16:12

JBO Page

PARK CITY MW-8  
 BUREAU OF SOLID AND HAZAR  
 DOUS WASTE

E.P. TOXICITY  
 +  
 T.M.

MW-8  
 TAILINGS

UTAH STATE HEALTH LABORATORY  
 Environmental Chemistry Analysis Report

Description: PARK CITY MW-8  
 Site ID: CW87124 Source: 00  
 Cost Code: 365  
 Lab Number: 8704583 Type: 40  
 Sample Date: 87/07/30 Time: 09:00  
 Tot. Cations:  
 Tot. Anions:  
 Grand Total:

Date of Review and QA Validation  
 Inorganic Review:  
 Organic Review:  
 Radiochemistry Review:  
 Microbiology Review:

Laboratory Analyses

T-Arsenic	70.0 ppm	T-Barium	90.0 ppm
T-Cadmium	16 ppm	T-Chromium	110.0 ppm
T-Copper	60.0 ppm	T-Iron	21000.0 ppm
T-Lead	470.0 ppm	T-Manganese	920.0 ppm
Mercury	0.7 ppm	T-Selenium	<30.0 ppm
T-Silver	<6.0 ppm	T-Zinc	1800.0 ppm
Arsenic HW	<0.2 ppm	Barium HW	0.23 ppm
Cadmium HW	0.15 ppm	Cr (HW)	<0.03 ppm
Lead (HW)	<0.2 ppm	Mercury HW	<0 ppm
Se (HW)	<0.2 ppm	Silver HW	<0.01 ppm
% Solids	83.6		

Approved by:

RECEIVED

SEP 01 1987

Bureau of Solid  
& Hazardous WastePARK CITY/SILVER CREEK PS MW 9 1-5'-2'  
SOLID AND HAZARDOUS WASTE

MW-9 (1.5-2 FT.)

TAILINGS

UTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: PARK CITY/SILVER CREEK PS MW 9 1-5'-2'

Site ID: CW87211 Source: 00

Cost Code: 365

Lab Number: 8704421 Type: 50

Date of Review and QA Validation

Inorganic Review: 87/08/31

Sample Date: 87/07/28 Time: 12:15

Organic Review:

Tot. Cations:

Radiochemistry Review: 87/08/31

Tot. Anions: me/l Cations:

Microbiology Review:

Grand Total: me/l Anions:

Laboratory Analyses

T-Arsenic	460.0 ppm	T-Barium	14.0 ppm
T-Cadmium	220 ppm	T-Chromium	35.0 ppm
T-Copper	490.0 ppm	T-Iron	>72000.0 ppm
T-Lead	8500.0 ppm	T-Manganese	2000.0 ppm
Mercury	0.8 ppm	T-Selenium	60.0 ppm
T-Silver	59.0 ppm	T-Zinc	31000.0 ppm
% Solids	90.0		

Approved by:

Rough estimate

**RECEIVED**

SEP 0 11987

Bureau of Solid  
& Hazardous WastePARK CITY/SILVER CREEK PS MW9 3'-3.5'  
SOLID AND HAZARDOUS WASTEMW-9 (3-3.5 FT.)  
TAILINGSUTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: PARK CITY/SILVER CREEK PS MW9 3'-3.5'

Site ID: CW87212 Source: 00

Cost Code: 365

Lab Number: 8704422 Type: 50

Date of Review and QA Validation

Sample Date: 87/07/28 Time: 12:30

Inorganic Review: 87/08/31

Tot. Cations:

Organic Review:

Tot. Anions: me/l Cations:

Radiochemistry Review: 87/08/31

Grand Total: me/l Anions:

Microbiology Review:

Laboratory Analyses

T-Arsenic	430.0 ppm	T-Barium	66.0 ppm
T-Cadmium	77 ppm	T-Chromium	33.0 ppm
T-Copper	630.0 ppm	T-Iron	34000.0 ppm
T-Lead	8300.0 ppm	T-Manganese	1900.0 ppm
Mercury	4.5 ppm	T-Selenium	<30.0 ppm
T-Silver	50.0 ppm	T-Zinc	13000.0 ppm
% Solids	86.0		

Approved by:

*J. Oman**Rough Estimate*

87/08/31 13:08

JBO Page

RECEIVED

PARK CITY SILVER CREEK PS MW9-29-30  
BUREAU OF SOLID AND HAZAR-  
DOUS WASTE

SEP 01 1987

Bureau of Solid  
& Hazardous Waste

MW-9 (29-30 FT.)

TAILINGS

UTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: PARK CITY SILVER CREEK PS MW9-29-30

Site ID: Source: 00

Cost Code: 365

Lab Number: 8704420 Type: 50

Date of Review and QA Validation

Inorganic Review: 87/08/31

Sample Date: 87/07/28 Time: 12:20

Organic Review:

Tot. Cations:

Radiochemistry Review: 87/08/31

Tot. Anions: me/l Cations:

Microbiology Review:

Grand Total: me/l Anions:

Laboratory Analyses

T-Arsenic	530.0 ppm	T-Barium	18.0 ppm
T-Cadmium	130 ppm	T-Chromium	29.0 ppm
T-Copper	730.0 ppm	T-Iron	>76000.0 ppm
T-Lead	9400.0 ppm	T-Manganese	1800.0 ppm
Mercury	3.0 ppm	T-Selenium	60.0 ppm
T-Silver	53.0 ppm	T-Zinc	19000.0 ppm
% Solids	83.4		

Approved by:

Rough Estimate

87/08/31 13:08

JBO Page

RECEIVED

PARK CITY MW-10 2-4  
BUREAU OF SOLID AND HAZAR-  
DOUS WASTE

SEP 01 1987

Bureau of Solid  
& Hazardous Waste

MW-10(2-4 PT)

TAILINGS

UTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: PARK CITY MW-10 2-4  
Site ID: CW87126 Source: 00  
Cost Code: 365  
Lab Number: 8704585 Type: 40  
Sample Date: 87/07/31 Time: 09:55  
Tot. Cations:  
Tot. Anions: me/l Cations:  
Grand Total: me/l Anions:

Date of Review and QA Validation  
Inorganic Review: 87/08/31  
Organic Review:  
Radiochemistry Review: 87/08/31  
Microbiology Review:

Laboratory Analyses

T-Arsenic	370.0 ppm	T-Barium	56.0 ppm
T-Cadmium	56 ppm	T-Chromium	19.0 ppm
T-Copper	620.0 ppm	T-Iron	11000.0 ppm
T-Lead	8700.0 ppm	T-Manganese	1800.0 ppm
Mercury	4.9 ppm	T-Selenium	<30.0 ppm
T-Silver	56.0 ppm	T-Zinc	12000.0 ppm
% Solids	83.0		

Approved by:

J. Oman  
Rough Estimate

87/08/31 13:09

## Environmental Chemistry

JBO Page

RECEIVED

SEP 0 1 1987

PARK CITY MW-10  
BUREAU OF SOLID AND HAZAR-  
DOUS WASTE

Bureau of Solid  
& Hazardous Waste

MW-10  
LIQUID

UTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: PARK CITY MW-10  
Site ID: CW87122 Source: 00  
Cost Code: 365  
Lab Number: 8704588 Type: 40  
Sample Date: 87/07/31 Time: 09:00  
Tot. Cations:  
Tot. Anions:  
Grand Total:

Date of Review and QA Validation  
Inorganic Review: 87/08/31  
Organic Review:  
Radiochemistry Review: 87/08/31  
Microbiology Review:

Laboratory Analyses

T-Arsenic	830.0 ppm	T-Barium	250.0 ppm
T-Cadmium	<85 ppm	T-Chromium	<85.0 ppm
T-Copper	1100.0 ppm	T-Iron	36000.0 ppm
T-Lead	12000.0 ppm	T-Manganese	1800.0 ppm
Mercury	18.0 ppm	T-Selenium	<420.0 ppm
T-Silver	80.0 ppm	T-Zinc	14000.0 ppm
% Solids	2.8		

Approved by:

J. Oman  
Rough Estimate

87/09/02 13:39

JBO Page:

RECEIVED

SEP 14 1997

PARK CITY MW-10 1-2  
BUREAU OF SOLID AND HAZAR-  
DOUS WASTE

Utah Dept. of Health  
Bureau of Solid & Hazardous Waste

MW-10(1-2 FT)  
TAILINGS

UTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: PARK CITY MW-10 1-2  
Site ID: CW87125 Source: 00  
Cost Code: 365  
Lab Number: 8704584 Type: 40  
Sample Date: 87/07/31 Time: 09:49  
Tot. Cations:  
Tot. Anions:  
Grand Total:

Date of Review and QA Validation  
Inorganic Review: 87/09/01  
Organic Review:  
Radiochemistry Review: 87/09/01  
Microbiology Review:

Laboratory Analyses

T-Arsenic	210.0 ppm	T-Barium	32.0 ppm
T-Cadmium	63 ppm	T-Chromium	32.0 ppm
T-Copper	360.0 ppm	T-Iron	20000.0 ppm
T-Lead	4800.0 ppm	T-Manganese	1900.0 ppm
Mercury	3.7 ppm	T-Selenium	<32.0 ppm
T-Silver	32.0 ppm	T-Zinc	11000.0 ppm
% Solids	91.0		

Approved by:



87/09/30 15:48

JBO Page

*CUTTINGS/H<sub>2</sub>O SAMPLES  
FROM DRILLING*

**RECEIVED**

OCT 02 1987

PARK CITY SILVER CREEK/PROSPECTOR SQUARE MW-12 Utah Dept. of Health  
BUREAU OF SOLID AND HAZARDOUS WASTE  
Bureau of Solid & Hazardous Waste

PARK CITY SILVER CREEK/PROSPECTOR SQUARE MW-12 Utah Dept. of Health  
BUREAU OF SOLID AND HAZARDOUS WASTE

MW-12(TAILINGS) = 2D

UTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: PARK CITY SILVER CREEK/PROSPECTOR SQUARE MW-12 = 2D  
Site ID: Source: 00

Cost Code: 365

Lab Number: 8704876 Type: 40

Date of Review and QA Validation

Inorganic Review: 87/09/30

Sample Date: 87/08/14 Time: 16:00

Organic Review:

Tot. Cations:

Radiochemistry Review: 87/09/30

Tot. Anions: me/l Cations:

Microbiology Review:

Grand Total: me/l Anions:

Laboratory Analyses

T-Arsenic	51.0 ppm
T-Cadmium	7.2 ppm
T-Copper	22.0 ppm
T-Lead	72.0 ppm
Mercury	0.04 ppm
T-Silver	<0.6 ppm
Arsenic HW	<0.5 ppm
Cadmium HW	<0.13 ppm
Lead (HW)	<0.5 ppm
Se (HW)	<0.5 ppm
% Solids	82.9

T-Barium	72.0 ppm
T-Chromium	33.0 ppm
T-Iron	20000.0 ppm
T-Manganese	720.0 ppm
T-Selenium	<12.0 ppm
T-Zinc	190.0 ppm
Barium HW	0.15 ppm
Cr (HW)	<0.08 ppm
Mercury HW	<0 ppm
Silver HW	<0.03 ppm

Approved by:

*J. Oman*

87/09/30 15:48

JBO Page

PARK CITY SILVER CREEK/PROSPECTOR SQUARE MW-12  
BUREAU OF SOLID AND HAZAR  
DOUS WASTE

MW-12 (CUTTINGS) = 2D - LIQUID

UTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: PARK CITY SILVER CREEK/PROSPECTOR SQUARE MW-12 = 2D  
Site ID: Source: 00  
Cost Code: 365  
Lab Number: 8704875 Type: 40  
Sample Date: 87/08/14 Time: 16:00  
Tot. Cations:  
Tot. Anions:  
Grand Total:

Date of Review and QA Validation  
Inorganic Review: 87/09/30  
Organic Review:  
Radiochemistry Review: 87/09/30  
Microbiology Review:

Laboratory Analyses

T-Arsenic	130.0 ppm	T-Barium	230.0 ppm
T-Cadmium	<23 ppm	T-Chromium	98.0 ppm
T-Copper	54.0 ppm	T-Iron	37000.0 ppm
T-Lead	360.0 ppm	T-Manganese	1600.0 ppm
Mercury	0.58 ppm	T-Selenium	<90.0 ppm
T-Silver	<5.0 ppm	T-Zinc	490.0 ppm
Arsenic HW	<0.5 ppm	Barium HW	0.75 ppm
Cadmium HW	<0.13 ppm	Cr (HW)	<0.08 ppm
Lead (HW)	<0.5 ppm	Mercury HW	<0 ppm
Se (HW)	<0.5 ppm	Silver HW	<0.03 ppm
% SOLIDS	3.8		

Approved by:

J. Oman

PARK CITY SILVER CREEK / PROSPECTOR SQUARE  
BUREAU OF SOLID AND HAZAR  
DOUS WASTE

MW-12 = 2D TAILINGS

UTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: PARK CITY SILVER CREEK / PROSPECTOR SQUARE

Site ID: Source: 00

Cost Code: 365

Lab Number: 8704874 Type: 40

Date of Review and QA Validation

Sample Date: 87/08/13 Time: 11:28

Inorganic Review: 87/09/30

Tot. Cations:

Organic Review:

Tot. Anions: me/l Cations:

Radiochemistry Review: 87/09/30

Grand Total: me/l Anions:

Microbiology Review:

Laboratory Analyses

T-Arsenic	34.0 ppm	T-Barium	54.0 ppm
T-Cadmium	5.3 ppm	T-Chromium	37.0 ppm
T-Copper	21.0 ppm	T-Iron	13000.0 ppm
T-Lead	97.0 ppm	T-Manganese	260.0 ppm
Mercury	0.04 ppm	T-Selenium	<12.0 ppm
T-Silver	1.7 ppm	T-Zinc	160.0 ppm
Arsenic HW	<0.5 ppm	Barium HW	0.25 ppm
Cadmium HW	<0.12 ppm	Cr (HW)	<0.08 ppm
Lead (HW)	<0.5 ppm	Mercury HW	<0 ppm
Se (HW)	<0.5 ppm	Silver HW	<0.03 ppm
% Solids	82.2		

Approved by:

J. Oman

87/09/30 15:47

JBO Page

RECEIVED

OCT 02 07

Utah Dept. of  
Repos. of Solid & Hazardous Waste

MW-12 = 2D LIQUID

PARK CITY SILVER CREEK/PROSPECTOR SQUARE  
 BUREAU OF SOLID AND HAZARDOUS WASTE

UTAH STATE HEALTH LABORATORY  
 Environmental Chemistry Analysis Report

Description: PARK CITY SILVER CREEK/PROSPECTOR SQUARE

Site ID: Source: 00

Cost Code: 365

Lab Number: 8704873 Type: 40

Date of Review and QA Validation

Sample Date: 87/08/13 Time: 11:40

Inorganic Review: 87/09/30

Tot. Cations:

Organic Review:

Tot. Anions: me/l Cations:

Radiochemistry Review: 87/09/30

Grand Total: me/l Anions:

Microbiology Review:

Laboratory Analyses

T-Arsenic	140.0 ppm	T-Barium	300.0 ppm
T-Cadmium	<35 ppm	T-Chromium	84.0 ppm
T-Copper	34.0 ppm	T-Iron	31000.0 ppm
T-Lead	150.0 ppm	T-Manganese	300.0 ppm
Mercury	0.1 ppm	T-Selenium	<140.0 ppm
T-Silver	<7.0 ppm	T-Zinc	320.0 ppm
Arsenic HW	<0.5 ppm	Barium HW	0.95 ppm
Cadmium HW	<0.13 ppm	Cr (HW)	<0.08 ppm
Lead (HW)	<0.5 ppm	Mercury HW	<0 ppm
Se (HW)	<0.5 ppm	Silver HW	<0.03 ppm
% SOLIDS	3.0		

Approved by:

87/08/31 13:09

JBO Page:

**RECEIVED**

SEP 01 1987

PARK CITY PS-SO-LARSON

Bureau of Solid  
& Hazardous WasteUTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: PARK CITY PS-SO-LARSON

Site ID: Source: 00

Cost Code: 900

Lab Number: 8704611 Type: 50

Date of Review and QA Validation

Sample Date: 87/07/24 Time: 17:55

Inorganic Review: 87/08/31

Tot. Cations:

Organic Review:

Tot. Anions: me/l Cations:

Radiochemistry Review: 87/08/31

Grand Total: me/l Anions:

Microbiology Review:

Laboratory Analyses

T-Arsenic	150.0 ppm	T-Barium	150.0 ppm
T-Cadmium	30 ppm	T-Chromium	210.0 ppm
T-Copper	280.0 ppm	T-Iron	37000.0 ppm
T-Lead	2900.0 ppm	T-Manganese	2800.0 ppm
Mercury	2.5 ppm	T-Selenium	<30.0 ppm
T-Silver	20.0 ppm	T-Zinc	4000.0 ppm
% Solids	95.7		

*Rough  
Estimate*

TABLE 1

TAILINGS CHARACTERIZATION SAMPLES  
 SUBSURFACE SOILS (ug/l)  
 EP TOXICITY LEACHING TEST  
 PROSPECTOR SQUARE  
 PARK CITY, UTAH

SAMPLE NUMBER	PS-MW-3	PS-MW-4	PS-MW-5	PS-MW-5	PS-MW-5	PS-MW-5
TRAFFIC NUMBER	MHH-057	MHH-058	MHH-053	MHH-054	MHH-055	MHH-056
SAMPLE INTERVAL	1.0-2.0'	1.0-1.5'	1.0-1.5'	4.0-5.5'	5.5-7.0'	7.5-9.0'
Aluminum	[87]j	[56]j	[66]nj	[196]j	[89]j	[103]j
Antimony	34uj	34uj	34uj	34uj	34uj	34uj
Arsenic	10uj	1.2uj	10uj	10uj	10uj	10uj
Barium	[22]	360	[138]	[61]	[82]	[21]
Beryllium	1.5uj	1.5uj	1.5u	1.5uj	1.5uj	1.5uj
Cadmium	583j	29j	675j	675j	608j	1070j
Calcium	32,900	388,000	165,000	150,000	184,000	25,900
Chromium	3.1uj	3.1uj	3.1uj	3.1uj	3.1uj	3.1uj
Cobalt	6.8u	6.8u	6.8u	6.8u	6.8u	6.8u
Copper	327	2.1u	179j	158j	100j	324j
Iron	17uj	17uj	17uj	[92]j	17uj	17uj
Lead	5640	51j	2370	2170j	1790j	1890j
Magnesium	[1920]	7400	[2870]	[2280]	[2850]	[1960]
Manganese	2410j	292j	2510j	2240j	2530j	2550j
Mercury	0.2uj	0.2uj	0.2u	0.2uj	0.2uj	0.2uj
Nickel	24u	24u	24u	24u	24u	24u
Potassium	[2020]	[2380]j	[1740]j	[1800]j	[2090]j	[1440]j
Selenium	5.0uj	2.0uj	[3.0]j	2.0j	2.0uj	2.0uj
Silver	[6.3]j	2.2uj	[8.6]j	[8.1]j	[6.0]j	[9.5]j
Sodium	[769]	[3600]j	[322]j	[295]	[414]j	[311]j
Thallium	[4.8]r	10r	2.1r	2.1r	2.1r	2.1r
Vanadium	[13]	[12]	[7.7]	[6.6]	[6.6]	[11]
Zinc	85,900r	1160	63,400	61,800	504,000	84,500

[] - indicated concentration detected at less than contract required detection limits.

u - indicates - undetected at this concentration

uj - detection limit estimated because not all quality control criteria were met

j - estimated value; not all quality control criteria were met

r - rejected data

TABLE 1

TAILINGS CHARACTERIZATION SAMPLES  
SUBSURFACE SOILS  
EP TOXICITY LEACHING TEST (ug/l)  
PROSPECTOR SQUARE  
PARK CITY, UTAH

SAMPLE NUMBER	PS-MW-9	PS-MW-9	PS-MW-9	EP TOXI-	EPA HAZ-
TRAFFIC NUMBER	MHH-059	MHH-060	MHH-061	CITY	ARDOUS
SAMPLE INTERVAL	3.0-4.0'	1.5-2.0'	2.4-3.0'	STANDARD	NUMBER
Aluminum	[53]j	[27]uj	[99]j		
Antimony	[39]j	[34]uj	34uj		
Arsenic	10uj	1.2uj	10uj	5000	D0004
Barium	[161]	[69]	[83]	100,000	D0005
Beryllium	1.5uj	1.5uj	1.5uj		
Cadmium	277j	834j	643	1000	D0006
Calcium	204,000	410,000	167,000		
Chromium	3.1uj	3.1uj	3.1uj	5000	D0008
Cobalt	6.8u	6.8u	[14]		
Copper	232j	78j	230j		
Iron	17uj	17uj	17uj		
Lead	590j	1970j	1760j	5000	
Magnesium	[2770]	6240	[4460]		
Manganese	4450j	3100j	6500j		
Mercury	0.2uj	0.7j	0.2uj	200	D0009
Nickel	24u	24u	24u		
Potassium	[538]j	180uj	[712]j		
Selenium	2.0uj	5.0uj	2.0uj	1000	D0010
Silver	2.2uj	2.2uj	[2.4]uj	5000	D0011
Sodium	[1900]	[1220]j	[1090]		
Thallium	10r	10r	2.1r		
Vanadium	[4.9]	2.9u	[3.6]		
Zinc	14100	52,100r	44,000		

[ ] - indicated concentration detected at less than contract required detection limits.

u - indicates - undetected at this concentration

uj - detection limit estimated because not all quality control criteria were met

j - estimated value; not all quality control criteria were met

r - rejected data

TABLE 2  
 EP TOXICITY ANALYTICAL RESULTS, (ug/l)  
 SUBSURFACE BOREHOLE SAMPLES  
 PROSPECTOR SQUARE  
 PARK CITY, UT  
 CASE #3317H

SAMPLE NUMBER	BH-01	BH-01	BH-02	BH-02	BH-02
DEPTH	3.5'-4.0'	4.0'-5.5'	0.0'-2.0'	2.0'-4.0'	4.0'-5.0'
TRAFFIC NUMBER	MHH-092	MHH-093	MHH-091	MHH-094	MHH-095
Aluminum	78u	78u	78u	78u	78u
Antimony	50u	50u	50u	50u	96
Arsenic	10u	10u	10u	10u	10u
Barium	[108]	[164]	[27]	23u	23u
Beryllium	2u	2u	2u	2u	2u
Cadmium	251	178	792	904	1090
Calcium	19100	29600	661000	655000j	674000j
Chromium	22	9u	9u	9u	9u
Cobalt	20u	20u	[20]	20u	20u
Copper	9u	9u	53	221	578
Iron	113	43u	[43]	43u	43u
Lead	5.82 j	154 j	2910 j	2540 j	2440 j
Magnesium	[1970]	[3730]	[3360]	11300	7050
Manganese	169 j	379 j	3990 j	5900	7330
Mercury	0.2u	0.2u	1.3	2.5j	0.2j
Nickel	25u	25u	25u	68 j	25u
Potassium	[4550]	[4370]	[1210]	[1050]	[1170]
Selenium	5u	5u	5u	5u	25u
Silver	8u	8u	8u	8u	8u
Sodium	[4390]	[3820]	[2010]	7190	7390
Thallium	10u	10u	10u	10u	10u
Tin	38u	38u	38u	38u	38u
Vanadium	11u	11u	11u	11u	11u
Zinc	12900	10100	96500	102000	108000

[ ] - indicated concentration detected at less than contract required detection limits.

u - indicates - undetected at this concentration

uj - detection limit estimated because not all quality control criteria were met

j - estimated value; not all quality control criteria were met

r - rejected data

TABLE 3  
(SOLUBILITY CONSTANTS) PREDICTED ZINC  
CONCENTRATIONS (ug/l) VERSUS pH

log Kg	Zn <sup>2+</sup>	ZnOH <sup>+</sup>	ZnCO <sub>3</sub>
	11.2	2.2	7.95 <sup>3</sup>
pH 5.5	130,000	205,550	10,183
pH 6.5	10,980	72,172	315
pH 7.0	2,740	42,766	45

87/10/27 17:33

JBO Pag

PARK CITY MW-1D  
BUREAU OF SOLID AND HAZAR  
DOUS WASTE

UTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: PARK CITY MW-1D  
Site ID: CW87123 Source: 00  
Cost Code: 365  
Lab Number: 8704589 Type: 40  
Sample Date: 87/08/03 Time: 12:35  
Tot. Cations:  
Tot. Anions: me/l Cations:  
Grand Total: me/l Anions:

Date of Review and QA Validation  
Inorganic Review: 87/10/27  
Organic Review:  
Radiochemistry Review: 87/10/27  
Microbiology Review:

Laboratory Analyses

T-Arsenic	47.0 ppm	T-Barium	110.0 ppm
T-Cadmium	6 ppm	T-Chromium	100.0 ppm
T-Copper	35.0 ppm	T-Iron	24000.0 ppm
T-Lead	110.0 ppm	T-Manganese	880.0 ppm
Mercury	0.089 ppm	T-Selenium	<30.0 ppm
T-Silver	<6.0 ppm	T-Zinc	160.0 ppm
Arsenic HW	NO ppm	Barium HW	NO ppm
Cadmium HW	NO ppm	Cr (HW)	NO ppm
Lead (HW)	NO ppm	Mercury HW	NO ppm
Se (HW)	NO ppm	Silver HW	NO ppm
% Solids	81.3		

Approved by:

 Oman

87/10/07 16:11

JBO Page

PROSPECTOR SQUARE  
M.SLAM BUREAU OF SOLID  
AND HAZARDOUS WASTE

E.P. TOXICITY  
+  
T.M.

MW-1

UTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report TAILINGS

Description: PROSPECTOR SQUARE  
Site ID: Source: 00  
Cost Code: 365  
Lab Number: 8704125 Type: 50  
Sample Date: 87/07/16 Time:  
Tot. Cations:  
Tot. Anions:  
Grand Total:

Date of Review and QA Validation  
Inorganic Review:  
Organic Review:  
Radiochemistry Review:  
Microbiology Review:

Laboratory Analyses

T-Arsenic	6.0 ppm	T-Barium	34.0 ppm
T-Cadmium	13 ppm	T-Chromium	50.0 ppm
T-Lead	110.0 ppm	T-Manganese	500.0 ppm
Mercury	<1.0 ppm	T-Silver	1.3 ppm
T-Zinc	250.0 ppm	Arsenic HW	<0.2 ppm
Barium HW	0.093 ppm	Cadmium HW	<0.05 ppm
Cr (HW)	<0.03 ppm	Lead (HW)	<0.2 ppm
Mercury HW	<0 ppm	Se (HW)	<0.2 ppm
Silver HW	0.01 ppm	% Solids	94.0

Approved by:

 Oman

PARK CITY MW-1  
M.SLAM BUREAU OF SOLID  
AND HAZARDOUS WASTE

E.P. TOXICITY

T  
T.M.

MW-1  
LIQUID

UTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: PARK CITY MW-1  
Site ID: CW87160 Source: 00  
Cost Code: 365  
Lab Number: 8704099 Type: 40  
Sample Date: 87/07/15 Time: 14:30  
Tot. Cations:  
Tot. Anions:  
Grand Total:

Date of Review and QA Validation  
Inorganic Review:  
Organic Review:  
Radiochemistry Review:  
Microbiology Review:

Laboratory Analyses

T-Arsenic	13.0 ppm	T-Barium	480.0 ppm
T-Cadmium	21 ppm	T-Chromium	115.0 ppm
T-Lead	170.0 ppm	T-Manganese	4800.0 ppm
Mercury	<2.0 ppm	T-Silver	5.0 ppm
T-Zinc	310.0 ppm	Arsenic HW	<0.2 ppm
Barium HW	0.57 ppm	Cadmium HW	<0.05 ppm
Cr (HW)	<0.03 ppm	Lead (HW)	<0.2 ppm
Mercury HW	<0 ppm	Se (HW)	<0.2 ppm
Silver HW	<0.01 ppm	%SOLIDS	8.2

Approved by:

J. Cramer

87/07/17 12:57

JBO Page:

## RECEIVED

JUL 20 1987

Utah Dept. of Health  
Bureau of Solid & Hazardous WastePROSPECTOR SQUARE MW-1  
M.SALM BUREAU OF SOLID  
AND HAZARDOUS WASTEMW-1  
TAILINGSUTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: PROSPECTOR SQUARE MW-1

Site ID: Source: 00

Cost Code: 365

Lab Number: 8704124 Type: 50

Date of Review and QA Validation

Sample Date: 87/07/16 Time:

Inorganic Review: 87/07/17

Tot. Cations:

Organic Review:

Tot. Anions: me/l Cations:

Radiochemistry Review: 87/07/17

Grand Total: me/l Anions:

Microbiology Review:

Laboratory Analyses

T-Arsenic	<10.0 ppm (<.2)	T-Barium	100.0 ppm (2.2)
T-Cadmium	17 ppm (1.3)	T-Chromium	73.0 ppm (1.5)
T-Lead	77.0 ppm (1.6)	T-Manganese	980.0 ppm (2.6)
Mercury	<1.0 ppm (<.1)	T-Silver	2.0 ppm (0.4)
T-Zinc	170.0 ppm (3.6)	% Solids	83.3

Approved by:

 ± 25%\*DRY WEIGHT BASIS  
\*\*AS RECEIVED BASIS

**RECEIVED**

SEP 01 1987

Bureau of Solid  
& Hazardous Waste

PARK CITY PS-SO-1B

Mw-1D  
TAILINGSUTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: PARK CITY PS-SO-1B  
Site ID: Source: 00  
Cost Code: 900  
Lab Number: 8704608 Type: 50  
Sample Date: 87/07/21 Time: 14:50  
Tot. Cations:  
Tot. Anions:  
Grand Total:

Date of Review and QA Validation  
Inorganic Review: 87/08/31  
Organic Review:  
Radiochemistry Review: 87/08/31  
Microbiology Review:

Laboratory Analyses

T-Arsenic	60.0 ppm	T-Barium	160.0 ppm
T-Cadmium	7 ppm	T-Chromium	60.0 ppm
T-Copper	50.0 ppm	T-Iron	21000.0 ppm
T-Lead	220.0 ppm	T-Manganese	640.0 ppm
Mercury	0.2 ppm	T-Selenium	<40.0 ppm
T-Silver	<7.0 ppm	T-Zinc	460.0 ppm
% Solids	71.4		

Rough  
Estimate

8704589

T-AS 47.000  
T-BA 110.00  
T-CD 6.000  
T-CR 100.00  
T-CU 35.000  
T-FE 24000.  
T-PB 110.00  
T-MN 880.00  
HG .089  
T-SE <30.000  
T-AG < 6.000  
T-ZN 160.00  
ASHW  
BAHW  
CDHW  
CRHW  
PBHW  
HGHW  
SE.HW  
AGHW

81.300

T-Arsenic, ug/l  
T-Barium, mg/l  
T-Cadmium, ug/l  
T-Chromium, ug/l  
T-Copper, ug/l  
T-Iron, mg/l  
T-Lead, ug/l  
T-Manganese, ug/l  
Mercury, ug/l  
T-Selenium, ug/l  
T-Silver, ug/l  
T-Zinc, ug/l  
Arsenic (HW), ppm  
Barium (HW), ppm  
Cadmium (HW), ppm  
Chromium (HW), ppm  
Lead (HW), ppm  
Mercury (HW), ppm  
Selenium (HW), ppm  
Silver (HW), ppm  
% Solids

## MW1D TAILINGS

CW87123  
MWD

Rough  
Estimate

J. Oman

RECEIVED

SEP 01 1987

Bureau of Solid  
& Hazardous Waste

87/08/27 13:29

JBO Page

SILVER CREEK PS MW3 1'-2'  
SOLID AND HAZARDOUS WASTE

MW-3  
TAILINGS

UTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: SILVER CREEK PS MW3 1'-2'  
Site ID: CW87213 Source: 00  
Cost Code: 365  
Lab Number: 8704423 Type: 50  
Sample Date: 87/07/28 Time: 08:41  
Tot. Cations:  
Tot. Anions:  
Grand Total:

Date of Review and QA Validation  
Inorganic Review:  
Organic Review:  
Radiochemistry Review:  
Microbiology Review:

Laboratory Analyses

T-Arsenic	380.0 ppm	T-Barium	210.0 ppm
T-Cadmium	190 ppm	T-Chromium	57.0 ppm
T-Copper	710.0 ppm	T-Iron	22000.0 ppm
T-Lead	13000.0 ppm	T-Manganese	2000.0 ppm
Mercury	3.7 ppm	T-Selenium	<30.0 ppm
T-Silver	67.0 ppm	T-Zinc	23000.0 ppm
% Solids			

Approved by:

**RECEIVED**

SEP 01 1987

Bureau of Solid  
& Hazardous WasteSILVER CREEK PS MW3 1'-2'  
SOLID AND HAZARDOUS WASTEMW-3  
TAILINGSUTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: SILVER CREEK PS MW3 1'-2'

Site ID: CW87213 Source: 00

Cost Code: 365

Lab Number: 8704423 Type: 50

Date of Review and QA Validation

Sample Date: 87/07/28 Time: 08:41

Inorganic Review: 87/08/31

Tot. Cations:

Organic Review:

Tot. Anions: me/l Cations:

Radiochemistry Review: 87/08/31

Grand Total: me/l Anions:

Microbiology Review:

Laboratory Analyses

T-Arsenic	380.0 ppm
T-Cadmium	190 ppm
T-Copper	710.0 ppm
T-Lead	13000.0 ppm
Mercury	3.7 ppm
T-Silver	67.0 ppm
% Solids	91.7

T-Barium	210.0 ppm
T-Chromium	57.0 ppm
T-Iron	22000.0 ppm
T-Manganese	2000.0 ppm
T-Selenium	<30.0 ppm
T-Zinc	23000.0 ppm

Approved by:

Rough Estimate

87/10/07 16:12

JBO Page

PARK CITY MW-3  
BUREAU OF SOLID AND HAZAR  
DOUS WASTE

E.P. TOXICITY  
+  
T.M. MW-3  
LIQUID

UTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: PARK CITY MW-3  
Site ID: CW87120 Source: 00  
Cost Code: 365  
Lab Number: 8704586 Type: 40  
Sample Date: 87/07/29 Time: 12:30  
Tot. Cations:  
Tot. Anions: me/l Cations:  
Grand Total: me/l Anions:

Date of Review and QA Validation  
Inorganic Review:  
Organic Review:  
Radiochemistry Review:  
Microbiology Review:

Laboratory Analyses

T-Arsenic	<180.0 ppm	T-Barium	260.0 ppm
T-Cadmium	<40 ppm	T-Chromium	110.0 ppm
T-Copper	37.0 ppm	T-Iron	31000.0 ppm
T-Lead	150.0 ppm	T-Manganese	810.0 ppm
Mercury	0.1 ppm	T-Selenium	<180.0 ppm
T-Silver	<40.0 ppm	T-Zinc	410.0 ppm
Arsenic HW	<0.2 ppm	Barium HW	0.36 ppm
Cadmium HW	<0.05 ppm	Cr (HW)	<0.03 ppm
Lead (HW)	<0.2 ppm	Mercury HW	<0 ppm
Se (HW)	<0.2 ppm	Silver HW	<0.01 ppm
% Solids	6.0		

Approved by:



87/08/31 13:09

**RECEIVED**

SEP 01 1987

Bureau of Solid  
& Hazardous Waste

PARK CITY PS-SO-3A

MW-3

TAILINGS

UTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: PARK CITY PS-SO-3A  
Site ID: Source: 00  
Cost Code: 900  
Lab Number: 8704610 Type: 50  
Sample Date: 87/07/23 Time: 13:40  
Tot. Cations:  
Tot. Anions:  
Grand Total:

Date of Review and QA Validation  
Inorganic Review: 87/08/31  
Organic Review:  
Radiochemistry Review: 87/08/31  
Microbiology Review:

Laboratory Analyses

T-Arsenic	120.0 ppm	T-Barium	76.0 ppm
T-Cadmium	30 ppm	T-Chromium	40.0 ppm
T-Copper	160.0 ppm	T-Iron	25000.0 ppm
T-Lead	4800.0 ppm	T-Manganese	1000.0 ppm
Mercury	3.2 ppm	T-Selenium	<30.0 ppm
T-Silver	10.0 ppm	T-Zinc	5400.0 ppm
% Solids	82.3		

Rough  
Estimate

87/09/02 13:39

JBO Pag

## RECEIVED

SEP 14 1987

SILVER CREEK MW-4  
BUREAU OF SOLID AND HAZAR-  
DOUS WASTE

Utah Dept. of Health  
Bureau of Solid & Hazardous Waste

MW-4  
TAILINGS

UTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: SILVER CREEK MW-4  
Site ID: Source: 00  
Cost Code: 365  
Lab Number: 8704246 Type: 50  
Sample Date: 87/07/18 Time: 10:15  
Tot. Cations:  
Tot. Anions:  
Grand Total:

Date of Review and QA Validation  
Inorganic Review: 87/09/02  
Organic Review:  
Radiochemistry Review: 87/09/02  
Microbiology Review:

Laboratory Analyses

T-Arsenic	<45.0 ppm	T-Barium	110.0 ppm
T-Cadmium	<5 ppm	T-Chromium	27.0 ppm
T-Copper	35.0 ppm	T-Iron	17000.0 ppm
T-Lead	97.0 ppm	T-Manganese	280.0 ppm
Mercury	0.02 ppm	T-Selenium	<45.0 ppm
T-Silver	<9.0 ppm	T-Zinc	150.0 ppm
% Solids	94.0		

Approved by:

*J. Green*

87/08/31 13:09

JBO Page

RECEIVED

SEP 0 1 1987

PARK CITY PS-SO-4A

Bureau of Solid  
& Hazardous WasteMW-9  
TAILINGSUTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: PARK CITY PS-SO-4A  
Site ID: Source: 00  
Cost Code: 900  
Lab Number: 8704609 Type: 50  
Sample Date: 87/07/23 Time: 17:15  
Tot. Cations:  
Tot. Anions:  
Grand Total:

Date of Review and QA Validation  
Inorganic Review: 87/08/31  
Organic Review:  
Radiochemistry Review: 87/08/31  
Microbiology Review:

Laboratory Analyses

T-Arsenic	320.0 ppm	T-Barium	160.0 ppm
T-Cadmium	67 ppm	T-Chromium	87.0 ppm
T-Copper	510.0 ppm	T-Iron	25000.0 ppm
T-Lead	5600.0 ppm	T-Manganese	2800.0 ppm
Mercury	4.1 ppm	T-Selenium	<25.0 ppm
T-Silver	40.0 ppm	T-Zinc	12000.0 ppm
% Solids	96.7		

Rough  
Estimate

87/09/02 13:39

JBO Page

## RECEIVED

SEP 14 1987

SILVER CREEK MW-5 1-1.5  
BUREAU OF SOLID AND HAZAR-  
DOUS WASTE

Utah Dept. of Health  
Bureau of Solid & Hazardous Waste

MW-5  
TAILINGS

UTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: SILVER CREEK MW-5 1-1.5

Site ID: Source: 00

Cost Code: 365

Lab Number: 8704247 Type: 50

Sample Date: 87/07/20 Time: 11:40

Tot. Cations:

Tot. Anions: me/l Cations:

Grand Total: me/l Anions:

Date of Review and QA Validation

Inorganic Review: 87/09/02

Organic Review:

Radiochemistry Review: 87/09/02

Microbiology Review:

Laboratory Analyses

T-Arsenic	410.0 ppm
T-Cadmium	83 ppm
T-Copper	680.0 ppm
T-Lead	6800.0 ppm
Mercury	4.5 ppm
T-Silver	52.0 ppm
% Solids	95.2

T-Barium	94.0 ppm
T-Chromium	36.0 ppm
T-Iron	20000.0 ppm
T-Manganese	2100.0 ppm
T-Selenium	<26.0 ppm
T-Zinc	16000.0 ppm

Approved by:



87/09/02 13:39

JBO Page

**RECEIVED**

SEP 14 1987

SILVER CREEK MW5 4-5  
BUREAU OF SOLID AND HAZAR-  
DOUS WASTEUtah Dept. of Health  
Bureau of Solid & Hazardous Waste

MW-5 (4-5 FT)

TAILINGS

UTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: SILVER CREEK MW5 4-5  
Site ID: Source: 00  
Cost Code: 365  
Lab Number: 8704248 Type: 50  
Sample Date: 87/07/20 Time: 11:50  
Tot. Cations:  
Tot. Anions:  
Grand Total:

Date of Review and QA Validation  
Inorganic Review: 87/09/02  
Organic Review:  
Radiochemistry Review: 87/09/02  
Microbiology Review:

Laboratory Analyses

T-Arsenic	480.0 ppm	T-Barium	57.0 ppm
T-Cadmium	88 ppm	T-Chromium	31.0 ppm
T-Copper	570.0 ppm	T-Iron	17000.0 ppm
T-Lead	9300.0 ppm	T-Manganese	2400.0 ppm
Mercury	4.3 ppm	T-Selenium	<26.0 ppm
T-Silver	57.0 ppm	T-Zinc	17000.0 ppm
% Solids	91.6		

Approved by:

87/09/02 13:39

JBO Page

RECEIVED

SEP 14 1987

SILVER CREEK MW 5-5--7-5  
BUREAU OF SOLID AND HAZAR-  
DOUS WASTE

Utah Dept. of Health  
Bureau of Solid & Hazardous Waste

UTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

MW-S (S-7.5 FT)

TAILINGS

Description: SILVER CREEK MW 5-5--7-5

Site ID: Source: 00

Cost Code: 365

Lab Number: 8704249 Type: 50

Date of Review and QA Validation

Sample Date: 87/07/20 Time:

Inorganic Review: 87/09/02

Tot. Cations:

Tot. Anions: me/l Cations:

Organic Review:

Grand Total: me/l Anions:

Radiochemistry Review: 87/09/02

Microbiology Review:

Laboratory Analyses

T-Arsenic	380.0 ppm
T-Cadmium	92 ppm
T-Copper	540.0 ppm
T-Lead	7000.0 ppm
Mercury	2.3 ppm
T-Silver	59.0 ppm
% Solids	91.8

T-Barium	59.0 ppm
T-Chromium	32.0 ppm
T-Iron	22000.0 ppm
T-Manganese	1900.0 ppm
T-Selenium	<27.0 ppm
T-Zinc	15000.0 ppm

Approved by:

**RECEIVED**

SEP 14 1987

SILVER CREEK MW5 7-9  
BUREAU OF SOLID AND HAZARDOUS WASTE

Utah Dept. of Health  
Bureau of Solid & Hazardous Waste

MW-5 (7-9FT.)

TAILINGS

UTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: SILVER CREEK MW5 7-9  
Site ID: Source: 00  
Cost Code: 365  
Lab Number: 8704250 Type: 50  
Sample Date: 87/07/20 Time:  
Tot. Cations:  
Tot. Anions: me/l Cations:  
Grand Total: me/l Anions:

Date of Review and QA Validation  
Inorganic Review: 87/09/02  
Organic Review:  
Radiochemistry Review: 87/09/02  
Microbiology Review:

Laboratory Analyses

T-Arsenic	400.0 ppm	T-Barium	120.0 ppm
T-Cadmium	82 ppm	T-Chromium	33.0 ppm
T-Copper	660.0 ppm	T-Iron	16000.0 ppm
T-Lead	7700.0 ppm	T-Manganese	2100.0 ppm
Mercury	3.8 ppm	T-Selenium	<27.0 ppm
T-Silver	55.0 ppm	T-Zinc	15000.0 ppm
% Solids	91.0		

Approved by:

87/08/31 13:09

JBO Page:

RECEIVED

SEP 01 1987

PARK CITY PS-SO-5A

Bureau of Solid  
& Hazardous WasteMW-5  
TAILINGSUTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: PARK CITY PS-SO-5A  
Site ID: Source: 00  
Cost Code: 900  
Lab Number: 8704612 Type: 50  
Sample Date: 87/07/24 Time: 14:50  
Tot. Cations:  
Tot. Anions:  
Grand Total:

Date of Review and QA Validation  
Inorganic Review: 87/08/31  
Organic Review:  
Radiochemistry Review: 87/08/31  
Microbiology Review:

Laboratory Analyses

T-Arsenic	210.0 ppm	T-Barium	75.0 ppm
T-Cadmium	40 ppm	T-Chromium	33.0 ppm
T-Copper	420.0 ppm	T-Iron	23000.0 ppm
T-Lead	4400.0 ppm	T-Manganese	1300.0 ppm
Mercury	5.1 ppm	T-Selenium	<30.0 ppm
T-Silver	27.0 ppm	T-Zinc	7000.0 ppm
% Solids	84.7		

Rough  
Estimate

87/10/07 16:12

JBO Page

PARK CITY PS-MW-6  
BUREAU OF SOLID AND HAZAR-  
DOUS WASTE

E.P. TOXICITY MW-6  
+ LIQUID  
T.M.

UTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: PARK CITY PS-MW-6  
Site ID: Source: 00  
Cost Code: 365  
Lab Number: 8704290 Type: 40  
Sample Date: 87/07/20 Time:  
Tot. Cations:  
Tot. Anions: me/l Cations:  
Grand Total: me/l Anions:

Date of Review and QA Validation  
Inorganic Review:  
Organic Review:  
Radiochemistry Review:  
Microbiology Review:

Laboratory Analyses

T-Arsenic	50.0 ppm	T-Barium	540.0 ppm
T-Cadmium	20 ppm	T-Chromium	110.0 ppm
T-Copper	61.0 ppm	T-Iron	32000.0 ppm
T-Lead	480.0 ppm	T-Manganese	1500.0 ppm
Mercury	4.0 ppm	T-Selenium	<50.0 ppm
T-Zinc	1500.0 ppm	Arsenic HW	<0.2 ppm
Barium HW	0.34 ppm	Cadmium HW	0.06 ppm
Cr (HW)	<0.03 ppm	Lead (HW)	<0.2 ppm
Mercury HW	<0 ppm	Se (HW)	<0.2 ppm
Silver HW	<0.01 ppm	% Solids	14.1

Approved by:

J. Oman

PARK CITY PS-MW-7  
BUREAU OF SOLID AND HAZAR-  
DOUS WASTE

E.P. TOXICITY  
+  
T.M

MW-7  
LIQUID

UTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: PARK CITY PS-MW-7  
Site ID: Source: 00  
Cost Code: 365  
Lab Number: 8704288 Type: 40  
Sample Date: 8/7/07/20 Time:  
Tot. Cations:  
Tot. Anions: me/l Cations:  
Grand Total: me/l Anions:

Date of Review and QA Validation  
Inorganic Review:  
Organic Review:  
Radiochemistry Review:  
Microbiology Review:

Laboratory Analyses

T-Arsenic	<100.0 ppm	T-Barium	920.0 ppm
T-Cadmium	42 ppm	T-Chromium	190.0 ppm
T-Copper	210.0 ppm	T-Iron	46000.0 ppm
T-Lead	1900.0 ppm	T-Manganese	1700.0 ppm
Mercury	12.0 ppm	T-Selenium	<100.0 ppm
T-Zinc	2900.0 ppm	Arsenic HW	<0.2 ppm
Barium HW	0.22 ppm	Cadmium HW	0.08 ppm
Cr (HW)	<0.03 ppm	Lead (HW)	0.25 ppm
Mercury HW	0.002 ppm	Se (HW)	<0.2 ppm
Silver HW	<0.01 ppm	% Solids	5.9

Approved by:



87/10/07 16:12

JBO Page

PARK CITY PS-MW-7  
BUREAU OF SOLID AND HAZAR-  
DOUS WASTE

E. P. TOXICITY  
+  
T. M. MW-7  
LIQUID

UTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: PARK CITY PS-MW-7  
Site ID: Source: 00  
Cost Code: 365  
Lab Number: 8704289 Type: 40  
Sample Date: 87/07/20 Time:  
Tot. Cations:  
Tot. Anions: me/l Cations:  
Grand Total: me/l Anions:

Date of Review and QA Validation  
Inorganic Review:  
Organic Review:  
Radiochemistry Review:  
Microbiology Review:

Laboratory Analyses

T-Arsenic	130.0 ppm	T-Barium	800.0 ppm
T-Cadmium	32 ppm	T-Chromium	160.0 ppm
T-Copper	260.0 ppm	T-Iron	40000.0 ppm
T-Lead	2600.0 ppm	T-Manganese	1600.0 ppm
Mercury	6.6 ppm	T-Selenium	<80.0 ppm
T-Zinc	3700.0 ppm	Arsenic HW	<0.2 ppm
Barium HW	0.27 ppm	Cadmium HW	0.12 ppm
Cr (HW)	<0.03 ppm	Lead (HW)	0.48 ppm
Mercury HW	0.007 ppm	Se (HW)	<0.2 ppm
Silver HW	<0.01 ppm	% Solids	16.6

Approved by:

87/08/31 13:08

JBO Page

RECEIVED

SEP 01 1987

Bureau of Solid  
& Hazardous WastePARK CITY MW-8  
BUREAU OF SOLID AND HAZAR-  
DOUS WASTEMW-8  
LIQUIDUTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: PARK CITY MW-8  
Site ID: CW87121 Source: 00  
Cost Code: 365  
Lab Number: 8704587 Type: 40  
Sample Date: 87/07/30 Time:  
Tot. Cations:  
Tot. Anions: me/l Cations:  
Grand Total: me/l Anions:

Date of Review and QA Validation  
Inorganic Review: 87/08/31  
Organic Review:  
Radiochemistry Review: 87/08/31  
Microbiology Review:

Laboratory Analyses

T-Arsenic	49.0 ppm	T-Barium	180.0 ppm
T-Cadmium	7 ppm	T-Chromium	70.0 ppm
T-Copper	28.0 ppm	T-Iron	23000.0 ppm
T-Lead	120.0 ppm	T-Manganese	920.0 ppm
Mercury	1.1 ppm	T-Selenium	<40.0 ppm
T-Silver	<7.0 ppm	T-Zinc	470.0 ppm
% Solids	28.2		

Approved by:

Rough Estimate

87/10/07 16:12

JBO Page

PARK CITY MW-8  
BUREAU OF SOLID AND HAZARDOUS WASTE

E.P. TOXICITY  
+  
T.M.

MW-8  
TAILINGS

UTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: PARK CITY MW-8  
Site ID: CW87124 Source: 00  
Cost Code: 365  
Lab Number: 8704583 Type: 40  
Sample Date: 87/07/30 Time: 09:00  
Tot. Cations:  
Tot. Anions:  
Grand Total:

Date of Review and QA Validation  
Inorganic Review:  
Organic Review:  
Radiochemistry Review:  
Microbiology Review:

Laboratory Analyses

T-Arsenic	70.0 ppm	T-Barium	90.0 ppm
T-Cadmium	16 ppm	T-Chromium	110.0 ppm
T-Copper	60.0 ppm	T-Iron	21000.0 ppm
T-Lead	470.0 ppm	T-Manganese	920.0 ppm
Mercury	0.7 ppm	T-Selenium	<30.0 ppm
T-Silver	<6.0 ppm	T-Zinc	1800.0 ppm
Arsenic HW	<0.2 ppm	Barium HW	0.23 ppm
Cadmium HW	0.15 ppm	Cr (HW)	<0.03 ppm
Lead (HW)	<0.2 ppm	Mercury HW	<0 ppm
Se (HW)	<0.2 ppm	Silver HW	<0.01 ppm
% Solids	83.6		

Approved by:

J. Oman

87/08/31 13:08

JBO Page

RECEIVED

SEP 01 1987

Bureau of Solid  
& Hazardous WastePARK CITY/SILVER CREEK PS MW 9 1-5'-2'  
SOLID AND HAZARDOUS WASTE

MW-9 (1.5-2 FT.)

TAILINGS

UTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: PARK CITY/SILVER CREEK PS MW 9 1-5'-2'

Site ID: CW87211 Source: 00

Cost Code: 365

Lab Number: 8704421 Type: 50

Date of Review and QA Validation

Sample Date: 87/07/28 Time: 12:15

Inorganic Review: 87/08/31

Tot. Cations:

Organic Review:

Tot. Anions: me/l Cations:

Radiochemistry Review: 87/08/31

Grand Total: me/l Anions:

Microbiology Review:

Laboratory Analyses

T-Arsenic	460.0 ppm	T-Barium	14.0 ppm
T-Cadmium	220 ppm	T-Chromium	35.0 ppm
T-Copper	490.0 ppm	T-Iron	>72000.0 ppm
T-Lead	8500.0 ppm	T-Manganese	2000.0 ppm
Mercury	0.8 ppm	T-Selenium	60.0 ppm
T-Silver	59.0 ppm	T-Zinc	31000.0 ppm
% Solids	90.0		

Approved by:

Rough estimate

## RECEIVED

SEP 01 1987

Bureau of Solid  
& Hazardous WastePARK CITY/SILVER CREEK PS MW9 3'-3.5'  
SOLID AND HAZARDOUS WASTEMW-9 (3-3.5 FT.)  
TAILINGSUTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: PARK CITY/SILVER CREEK PS MW9 3'-3.5'

Site ID: CW87212 Source: 00

Cost Code: 365

Lab Number: 8704422 Type: 50

Date of Review and QA Validation

Sample Date: 87/07/28 Time: 12:30

Inorganic Review: 87/08/31

Tot. Cations:

Organic Review:

Tot. Anions: me/l Cations:

Radiochemistry Review: 87/08/31

Grand Total: me/l Anions:

Microbiology Review:

Laboratory Analyses

T-Arsenic	430.0 ppm	T-Barium	66.0 ppm
T-Cadmium	77 ppm	T-Chromium	33.0 ppm
T-Copper	630.0 ppm	T-Iron	34000.0 ppm
T-Lead	8300.0 ppm	T-Manganese	1900.0 ppm
Mercury	4.5 ppm	T-Selenium	<30.0 ppm
T-Silver	50.0 ppm	T-Zinc	13000.0 ppm
% Solids	86.0		

Approved by:

Rough Estimate

87/08/31 13:08

JBO Page

**RECEIVED**

PARK CITY SILVER CREEK PS MW9-29-30  
BUREAU OF SOLID AND HAZAR  
DOUS WASTE

SEP 01 1987

Bureau of Solid  
& Hazardous Waste

MW-9 (29-30 FT.)

TAILINGS

UTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: PARK CITY SILVER CREEK PS MW9-29-30

Site ID: Source: 00

Cost Code: 365

Lab Number: 8704420 Type: 50

Date of Review and QA Validation

Sample Date: 87/07/28 Time: 12:20

Inorganic Review: 87/08/31

Tot. Cations:

Tot. Anions: me/l Cations:

Organic Review:

Grand Total: me/l Anions:

Radiochemistry Review: 87/08/31

Microbiology Review:

Laboratory Analyses

T-Arsenic	530.0 ppm	T-Barium	18.0 ppm
T-Cadmium	130 ppm	T-Chromium	29.0 ppm
T-Copper	730.0 ppm	T-Iron	>76000.0 ppm
T-Lead	9400.0 ppm	T-Manganese	1800.0 ppm
Mercury	3.0 ppm	T-Selenium	60.0 ppm
T-Silver	53.0 ppm	T-Zinc	19000.0 ppm
% Solids	83.4		

Approved by:

Rough Estimate

**RECEIVED**PARK CITY MW-10 2-4  
BUREAU OF SOLID AND HAZAR-  
DOUS WASTE

SEP 01 1987

Bureau of Solid  
& Hazardous Waste

MW-10(2-4FT.)

TAILINGS

UTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

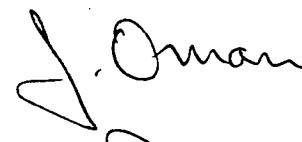
Description: PARK CITY MW-10 2-4  
Site ID: CW87126 Source: 00  
Cost Code: 365  
Lab Number: 8704585 Type: 40  
Sample Date: 87/07/31 Time: 09:55  
Tot. Cations:  
Tot. Anions:  
Grand Total:

Date of Review and QA Validation  
Inorganic Review: 87/08/31  
Organic Review:  
Radiochemistry Review: 87/08/31  
Microbiology Review:

Laboratory Analyses

T-Arsenic	370.0 ppm	T-Barium	56.0 ppm
T-Cadmium	56 ppm	T-Chromium	19.0 ppm
T-Copper	620.0 ppm	T-Iron	11000.0 ppm
T-Lead	8700.0 ppm	T-Manganese	1800.0 ppm
Mercury	4.9 ppm	T-Selenium	<30.0 ppm
T-Silver	56.0 ppm	T-Zinc	12000.0 ppm
% Solids	83.0		

Approved by:

  
J. Oman  
Rough Estimate

**RECEIVED**

SEP 01 1987

PARK CITY MW-10  
BUREAU OF SOLID AND HAZAR-  
DOUS WASTEBureau of Solid  
& Hazardous WasteMW-10  
LIQUIDUTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: PARK CITY MW-10  
Site ID: CW87122 Source: 00  
Cost Code: 365  
Lab Number: 8704588 Type: 40  
Sample Date: 87/07/31 Time: 09:00  
Tot. Cations:  
Tot. Anions:  
Grand Total:

Date of Review and QA Validation  
Inorganic Review: 87/08/31  
Organic Review:  
Radiochemistry Review: 87/08/31  
Microbiology Review:

Laboratory Analyses

T-Arsenic	830.0 ppm	T-Barium	250.0 ppm
T-Cadmium	<85 ppm	T-Chromium	<85.0 ppm
T-Copper	1100.0 ppm	T-Iron	36000.0 ppm
T-Lead	12000.0 ppm	T-Manganese	1800.0 ppm
Mercury	18.0 ppm	T-Selenium	<420.0 ppm
T-Silver	80.0 ppm	T-Zinc	14000.0 ppm
% Solids	2.8		

Approved by:

  
Oman  
Rough Estimate

**RECEIVED**

SEP 14 1997

PARK CITY MW-10 1-2  
BUREAU OF SOLID AND HAZAR-  
DOUS WASTEUtah Dept. of Health  
Bureau of Solid & Hazardous WasteMW-10 (1-2 FT)  
TAILINGSUTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: PARK CITY MW-10 1-2  
Site ID: CW87125 Source: 00  
Cost Code: 365  
Lab Number: 8704584 Type: 40  
Sample Date: 87/07/31 Time: 09:49  
Tot. Cations:  
Tot. Anions:  
Grand Total:

Date of Review and QA Validation  
Inorganic Review: 87/09/01  
Organic Review:  
Radiochemistry Review: 87/09/01  
Microbiology Review:

Laboratory Analyses

T-Arsenic	210.0 ppm	T-Barium	32.0 ppm
T-Cadmium	63 ppm	T-Chromium	32.0 ppm
T-Copper	360.0 ppm	T-Iron	20000.0 ppm
T-Lead	4800.0 ppm	T-Manganese	1900.0 ppm
Mercury	3.7 ppm	T-Selenium	<32.0 ppm
T-Silver	32.0 ppm	T-Zinc	11000.0 ppm
% Solids	91.0		

Approved by:

**CUTTINGS/H<sub>2</sub>O SAMPLES  
FROM DRILLING**

**RECEIVED**

OCT 02 1987

PARK CITY SILVER CREEK/PROSPECTOR SQUARE MW-12  
BUREAU OF SOLID AND HAZAR  
DOUS WASTE

Utah Dept. of Health  
Bureau of Solid & Hazardous Waste

MW-12(TAILINGS) = 2D

UTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: PARK CITY SILVER CREEK/PROSPECTOR SQUARE MW-12 = 2D  
Site ID: Source: 00

Cost Code: 365

Lab Number: 8704876 Type: 40

Sample Date: 87/08/14 Time: 16:00

Tot. Cations:

Tot. Anions: me/l Cations:

Grand Total: me/l Anions:

Date of Review and QA Validation

Inorganic Review: 87/09/30

Organic Review:

Radiochemistry Review: 87/09/30

Microbiology Review:

Laboratory Analyses

T-Arsenic	51.0 ppm	T-Barium	72.0 ppm
T-Cadmium	7.2 ppm	T-Chromium	33.0 ppm
T-Copper	22.0 ppm	T-Iron	20000.0 ppm
T-Lead	72.0 ppm	T-Manganese	720.0 ppm
Mercury	0.04 ppm	T-Selenium	<12.0 ppm
T-Silver	<0.6 ppm	T-Zinc	190.0 ppm
Arsenic HW	<0.5 ppm	Barium HW	0.15 ppm
Cadmium HW	<0.13 ppm	Cr (HW)	<0.08 ppm
Lead (HW)	<0.5 ppm	Mercury HW	<0 ppm
Se (HW)	<0.5 ppm	Silver HW	<0.03 ppm
Solids	82.9		

Approved by:

J. Oman

87/09/30 15:48

JBO Page

PARK CITY SILVER CREEK/PROSPECTOR SQUARE MW-12  
BUREAU OF SOLID AND HAZAR  
DOUS WASTE

MW-12(CUTTINGS) = 2D - L I Q U I D

UTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: PARK CITY SILVER CREEK/PROSPECTOR SQUARE MW-12 = 2D

Site ID: Source: 00

Cost Code: 365

Lab Number: 8704875 Type: 40

Date of Review and QA Validation

Sample Date: 87/08/14 Time: 16:00

Inorganic Review: 87/09/30

Tot. Cations:

Tot. Anions: me/l Cations:

Organic Review:

Grand Total: me/l Anions:

Radiochemistry Review: 87/09/30

Microbiology Review:

Laboratory Analyses

T-Arsenic	130.0 ppm	T-Barium	230.0 ppm
T-Cadmium	<23 ppm	T-Chromium	98.0 ppm
T-Copper	54.0 ppm	T-Iron	37000.0 ppm
T-Lead	360.0 ppm	T-Manganese	1600.0 ppm
Mercury	0.58 ppm	T-Selenium	<90.0 ppm
T-Silver	<5.0 ppm	T-Zinc	490.0 ppm
Arsenic HW	<0.5 ppm	Barium HW	0.75 ppm
Cadmium HW	<0.13 ppm	Cr (HW)	<0.08 ppm
Lead (HW)	<0.5 ppm	Mercury HW	<0 ppm
Se (HW)	<0.5 ppm	Silver HW	<0.03 ppm
% SOLIDS	3.8		

Approved by:

J. Oman

PARK CITY SILVER CREEK / PROSPECTOR SQUARE  
BUREAU OF SOLID AND HAZAR-  
DOUS WASTE

MW-12 = 2D TAILINGS

UTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: PARK CITY SILVER CREEK / PROSPECTOR SQUARE

Site ID: Source: 00

Cost Code: 365

Lab Number: 8704874 Type: 40

Date of Review and QA Validation

Sample Date: 87/08/13 Time: 11:28

Inorganic Review: 87/09/30

Tot. Cations:

Organic Review:

Tot. Anions: me/l Cations:

Radiochemistry Review: 87/09/30

Grand Total: me/l Anions:

Microbiology Review:

Laboratory Analyses

T-Arsenic	34.0 ppm	T-Barium	54.0 ppm
T-Cadmium	5.3 ppm	T-Chromium	37.0 ppm
T-Copper	21.0 ppm	T-Iron	13000.0 ppm
T-Lead	97.0 ppm	T-Manganese	260.0 ppm
Mercury	0.04 ppm	T-Selenium	<12.0 ppm
T-Silver	1.7 ppm	T-Zinc	160.0 ppm
Arsenic HW	<0.5 ppm	Barium HW	0.25 ppm
Cadmium HW	<0.12 ppm	Cr (HW)	<0.08 ppm
Lead (HW)	<0.5 ppm	Mercury HW	<0 ppm
Se (HW)	<0.5 ppm	Silver HW	<0.03 ppm
% Solids	82.2		

Approved by:

J. Oman

**RECEIVED**

OCT 02 07

Utah Dep't. of  
Bureau of Solid & Hazardous Waste

MW-12 = 20 LIQUID

PARK CITY SILVER CREEK/PROSPECTOR SQUARE  
 BUREAU OF SOLID AND HAZARDOUS WASTE

UTAH STATE HEALTH LABORATORY  
 Environmental Chemistry Analysis Report

Description: PARK CITY SILVER CREEK/PROSPECTOR SQUARE

Site ID: Source: 00

Cost Code: 365

Lab Number: 8704873 Type: 40

Date of Review and QA Validation

Sample Date: 87/08/13 Time: 11:40

Inorganic Review: 87/09/30

Tot. Cations:

Organic Review:

Tot. Anions: me/l Cations:

Radiochemistry Review: 87/09/30

Grand Total: me/l Anions:

Microbiology Review:

Laboratory Analyses

T-Arsenic	140.0 ppm	T-Barium	300.0 ppm
T-Cadmium	<35 ppm	T-Chromium	84.0 ppm
T-Copper	34.0 ppm	T-Iron	31000.0 ppm
T-Lead	150.0 ppm	T-Manganese	300.0 ppm
Mercury	0.1 ppm	T-Selenium	<140.0 ppm
T-Silver	<7.0 ppm	T-Zinc	320.0 ppm
Arsenic HW	<0.5 ppm	Barium HW	0.95 ppm
Cadmium HW	<0.13 ppm	Cr (HW)	<0.08 ppm
Lead (HW)	<0.5 ppm	Mercury HW	<0 ppm
Se (HW)	<0.5 ppm	Silver HW	<0.03 ppm
% SOLIDS	3.0		

Approved by:

**RECEIVED**

SEP 01 1987

PARK CITY PS-SO-LARSON

Bureau of Solid  
& Hazardous WasteUTAH STATE HEALTH LABORATORY  
Environmental Chemistry Analysis Report

Description: PARK CITY PS-SO-LARSON

Site ID: Source: 00

Cost Code: 900

Lab Number: 8704611 Type: 50

Date of Review and QA Validation

Sample Date: 87/07/24 Time: 17:55

Inorganic Review: 87/08/31

Tot. Cations:

Organic Review:

Tot. Anions: me/l Cations:

Radiochemistry Review: 87/08/31

Grand Total: me/l Anions:

Microbiology Review:

Laboratory Analyses

T-Arsenic	150.0 ppm
T-Cadmium	30 ppm
T-Copper	280.0 ppm
T-Lead	2900.0 ppm
Mercury	2.5 ppm
T-Silver	20.0 ppm
% Solids	95.7

T-Barium	150.0 ppm
T-Chromium	210.0 ppm
T-Iron	37000.0 ppm
T-Manganese	2800.0 ppm
T-Selenium	<30.0 ppm
T-Zinc	4000.0 ppm

Rough  
Estimate

ATTACHMENT H  
SAMPLING DATA

SAMPLING ROUND I

U.S. ENVIRONMENTAL PROTECTION AGENCY  
GROUNDWATER DATA

EPA - GW - I

[] - indicated concentration detected at less than contract required detection limits

u - indicates - undetected at this concentration

uj - detection limit estimated because not all quality control criteria were met

j - estimated value; not all quality control criteria were met

r - registered data

INORGANIC ANALYTICAL  
PROS

AFT

TABLE 1  
INORGANIC ANALYTICAL RESULTS, GROUND AND DRAIN WATERS (ug/l)  
PROSPECTOR SQUARE, PARK CITY, UTAH  
CASE 1

SAMPLE #	PS-MW-1S	PS-MW-1D	PS-MW-1C	PS-MW-1B	PS-MW-1A	PS-MW-1	PS-MW-8	PS-MW-150	PS-MW-6	PS-MW-7	PS-MW-11	PS-MW-9	PS-MW-10	PS-MW-13	PS-MW-14
TRAFFIC #	MHC-183	MHC-184	MHC-860	MHC-143	MHC-185	MHC-104	MHG-891	MHG-892	MHG-894	MHG-895	MHG-105	MHG-101	MHG-103	MHG-836	MHG-837
LOCATION	UPGRDN'T	DEEP W.	DEEP N.	ONSITE S.	N.W.	ONSITE N.	ONSITE	ONSITE	ONSITE	ONSITE	N. OF SITE	ONSITE E.	R. OF SITE	BLANK	DIA
W. OF SITE	OF SITE	OF SITE	OF SITE	OF SITE	OF SITE	OF SITE									
Aluminum	100u	100u	[135]	100u	100u	100u	100u	100u	[136]	100u	100u	100u	100u	100u	100u
Antimony	33u	33u	33u	33u	33u	33u	33u	33u	33u	33u	33u	33u	[54.5]	33u	33u
Arsenic	6u	6u	6u	6u	6u	6u	6u	6u	6u	6u	6u	6u	23.2	6u	6u
Barium	[103]	[91.6]j	[52.6]n	40ur	[47.1]j	[101]j	40ur	[42.5]j	40ur	40ur	[67.4]j	[57.4]j	[110]j	40ur	[1]
Beryllium	4u	4u	4u	4u	4u	4u	4u	4u	4u	4u	4u	4u	4u	4u	4u
Cadmium	4u	4u	4u	6.4	4u	4u	17.9	7.1	5.9	8.1	4u	4u	8.6	4u	4u
Calcium	354000	220000	64800	226000	21900	184000	228000	206000	247000	269000	320000	206000	140000	740u	69
Chromium	9u	9u	9u	9u	9u	9u	9u	9u	9u	9u	9u	9u	9u	9u	9u
Cobalt	7u	7u	7u	7u	7u	7u	7u	7u	7u	7u	7u	7u	7u	7u	7u
Copper	17u	17u	17u	17u	17u	27.8	17u	17u	17u	17u	17u	17u	[18.5]	17u	17u
Iron	100u	100u	100u	100u	100u	100u	100u	100u	100u	100u	100u	100u	100u	100u	100u
Lead	20uj	20uj	[2.75]j	2uj	2uj	20uj	2uj	2uj	2uj	2uj	2uj	20uj	43.4j	[2.31]j	2u
Cyanide	10u	10u	10u	10u	10u	10u	10u	10u	10u	10u	10u	10u	10u	10u	10u
Magnesium	61700	41300	17600	39100	41800	35900	32200	35200	34000	33200	58800	32800	36300	344u	18
Manganese	99.1	434	39.4	317	79.7	[8.8]	441	126	456	248	577	1290	1130	6u	41
Mercury	0.2u	0.2u	0.2u	0.2u	0.2u	0.2u	0.2u	0.2u	0.2u	0.2u	0.2u	0.2u	0.2u	0.2u	0.2u
Nickel	6u	[7.0]	6u	6u	6u	6u	[8.0]	[12.4]	6u	[10.2]	6u	6u	6u	6u	6u
Potassium	[4030]	[2320]	500u	8100	[1570]	[1630]	7490	5250	5480	7050	[1880]	[2650]	[3130]	500u	50
Selenium	20uj	2uj	2uj	20uj	2uj	2uj	2uj	20uj	20uj	20uj	20uj	2uj	2uj	2uj	2u
Silver	[9.2]	7u	[7.6]	7u	7u	7u	7u	7u	7u	7u	7u	7u	[9.7]	7u	7u
Sodium	277000	72100	11500	54900	51100	114000	48800	57100	44600	53100	44600	68100	46900	1045u	12
Thallium	80u	80u	8u	8u	8u	8u	8u	8u	8u	8u	8u	8u	8u	8u	8u
Vanadium	[21.8]	[18.2]	[15.3]	[13.7]	[13.1]	12u	[19.5]	[17.4]	[18.6]	[19.8]	[15.6]	[14.5]	12u	12u	12u
Zinc	22.5	7u	7u	1940	7u	7u	3210	2460	1210	2200	[9.9]	[7.7]	1950	7u	7u

SAMPLING ROUND II

U.S. ENVIRONMENTAL PROTECTION AGENCY  
GROUNDWATER DATA

## EPA-GW-II

TABLE 1  
 INORGANIC ANALYTICAL RESULTS GROUND AND DRAIN WATERS ( $\mu\text{g/l}$ )  
 PROSPECTOR SQUARE, PARK CITY, UTAH  
 SAS #3489H  
 DECEMBER, 1987

SAMPLE #	PS-MW-1S	PS-MW-1D	PS-MW-2D	PS-DR-1	PS-DR-2	PS-MW-2
TRAFFIC #	8-57454	8-57451	8-57460	8-57488	8-57497	8-57457
LOCATION	UPGRAD	UPGRAD	UPGRAD	DRAIN	DRAIN	ON-SITE
Aluminum	90u	[113]	90u	[94]	90u	90u
Antimony	45uj	45uj	45uj	[46]	45uj	45uj
Arsenic	2u	2u	2u	3.9	7.8	2u
Barium	[109]je	[79]je	[66]je	[20]je	[81]je	[67]je
Beryllium	2u	2u	2u	2u	2u	2u
Cadmium	[0.7]	1.3	.2u	27 s	1.5	[0.4]
Calcium	359,000	249,000	74,200	208,000	226,000	255,000
Chromium	10u	10u	10u	10u	10u	10u
Cobalt	25u	25u	25u	25u	25u	25u
Copper	8u	[18]	8u	8u	8u	8u
Iron	[57]	101	[23]	301	6510	[26]
Lead	[1.7]	[1.6]	[1.3]	7.0	5.1	[1.8]
Magnesium	62,100	49,300	20,300	28,500	47,400	50,500
Manganese	99	80	[8]	574	2,190	32
Mercury	0.2u	0.2u	0.2u	0.2u	0.2u	0.2u
Nickel	22u	22u	22u	22u	22u	22u
Potassium	[3520]je	[2390]je	[1110]je	[4480]je	[2940]je	[2040]je
Selenium	2u	2u	2u	2.0	2u	2u
Silver	6u	6u	6u	6u	6u	6u
Sodium	310,000	91,110	11,000	44,200	43,300	61,500
Thallium	2u	2u	2u	2u	2u	2u
Vanadium	13u	13u	13u	13u	13u	13u
Zinc	71	85	[17]	2,460	245	22
Cyanide	10uj	10uj	10uj	10uj	10uj	10uj

s - Indicates the value reported was determined by method of standard addition and is estimated.

j - The associated numerical value is an estimated quantity because the amount detected is below the required limits or because quality control criterias were not met.

u - The material was analyzed for, but was not detected. The associated numerical value is the estimated sample quantitation limit.

je - Indicates a value estimated or not reported due to presence of interference.

[] -Amount report is above is above instrument detection limits but below contract required detection limits. The value is an estimation.

TABLE 2  
 INORGANIC ANALYTICAL RESULTS GROUND WATERS ( $\mu\text{g/l}$ )  
 PROSPECTOR SQUARE, PARK CITY, UTAH  
 SAS #3489H

SAMPLE #	PS-MW-3	PS-MW-4	PS-MW-5	PS-MW-6	PS-MW-7	PS-MW-8
TRAFFIC #	8-57463	8-57466	8-57469	8-57475	8-57479	8-57472
LOCATION	ON-SITE	ONSITE TRP	ON-SITE	ON-SITE	ON-SITE	ON-SITE
Aluminum	90u	90u	90u	90u	429	90u
Antimony	45uj	45uj	45uj	[55]	45uj	45uj
Arsenic	2u	2u	2u	2u	2.1	[3.8]
Barium	[86]je	[47]je	[49]je	[23]je	[22]je	[24]je
Beryllium	2u	2u	2u	2u	2u	2u
Cadmium	[0.2]	3.2	3.1	5.8s	9.8s	16
Calcium	186,000	262,000	189,000	236,000	225,000	203,000
Chromium	10u	10u	10u	10u	10u	15
Cobalt	25u	25u	25u	25u	25u	25u
Copper	8u	8u	8u	8u	8u	8u
Iron	100	145	[32]	[89]	442	[21]
Lead	[2.5]	[3.1]	[2.7]	[2.0]	[4.0]	9.3
Magnesium	36,900	47,800	34,800	33,200	29,200	30,300
Manganese	[5]	2,250	276	287	70	472
Mercury	0.2u	0.2u	0.2u	0.2u	0.2u	0.2u
Nickel	22u	22u	22u	22u	22u	22u
Potassium	[1940]je	6930je	[3390]je	[4300]je	5340je	6160je
Selenium	2u	2u	2u	2u	2.4	2u
Silver	6u	6u	6u	6u	6u	6u
Sodium	134,000	62,600	55,200	43,800	50,300	49,900
Thallium	2u	2u	2u	2u	2u	2u
Vanadium	13u	13u	13u	13u	13u	13u
Zinc	[16]	759	899	1,300	2,150	2,890
Cyanide	10uj	10uj	10uj	10uj	10uj	10uj

u - The material was analyzed for, but was not detected. The associated numerical value is the estimated sample quantitation limit.

je - Indicates a value estimated or nor reported due to presence of interference. (Used when serial dilutions results are not within required limits).

uj - Detection limit is estimated because quality control criteria were not met.

[] - Compound is present and was detected. However, the quantity is below the contract required detection limit.

s - Indicates the value reported was determined by method of standard addition and is estimated.

TABLE 3  
 INORGANIC ANALYTICAL RESULTS GROUND WATERS ( $\mu\text{g/l}$ )  
 PROSPECTOR SQUARE, PARK CITY, UTAH  
 SAS #3489H

SAMPLE #	PS-MW-9	PS-MW-10	PS-MW-11	PS-MW-12	PS-MW-13	PS-MW-14	PS-MW-17
TRAFFIC #	8-57482	8-57491	8-57494	8-57500	8-53622	8-53624	8-57485
LOCATION	ON-SITE	ON-SITE	ON-SITE	BLANK	TRIP	SPIKE	DUP MW-9
Aluminum	[123]	90u	1000	90u	90u	90u	90u
Antimony	45uj	[46]	45u	45uj	45uj	45uj	45uj
Arsenic	3.4	11	2u	2u	2.0	9.4	5.5
Barium	[43]je	[94]je	[42]je	[2]je	[3]je	2uje	[48]je
Beryllium	2u	2u	2u	2u	2u	10	2u
Cadmium	0.2u	3.8	[0.9]	[0.3]	0.2u	2.7	[0.4]
Calcium	164,000	131,000	204,000	[235]	[39]	[43]	178,000
Chromium	10u	10u	10u	11	10u	17	10u
Cobalt	25u						
Copper	8u	8u	8u	8u	8u	[17]	[10]
Iron	476	[28]	1010	[80]	[29]	[47]	164
Lead	7.4	22	5.0	5.0	[2.9]	10	7.6
Magnesium	26,800	38,500	38,100	[81]	75u	75u	28,600
Manganese	1400	442	320	3u	3u	[10]	1450
Mercury	0.2u	0.52	0.2u	0.2u	0.2u	0.35	0.2u
Nickel	22u						
Potassium	[2190]je	[1950]je	[1930]je	372uje	372uje	372uje	[2330]je
Selenium	2u	2u	2u	2u	2u	2.5	2u
Silver	6u						
Sodium	48,700	40,900	34,300	[185]	[170]	[187]	55,200
Thallium	2u						
Vanadium	13u	13u	13u	13u	13u	[13]	13u
Zinc	[16]	697	31	13u	[13]	48	[19]
Cyanide	10uj	10uj	10uj	10uj	nr	nr	10uj

u - The material was analyzed for, but was not detected. The associated numerical value is the estimated sample quantitation limit.

uj - Detection limit is estimated because quality control criteria were not met.

je - Indicates a value estimated or nor reported due to presence of interference. (Used when serial dilutions results are not within required limits).

[] - Compound is present and was detected. However, the quantity is below the contract required detection limit.

nr - Analysis was not required.

PERFORMANCE EVALUATION SAMPLE

BLIND SPIKE SOLUTION PREPARED AS A  
COMPARABILITY STANDARD FOR CASE #3489B  
ANALYSIS OF 18 LOW VASTER SAMPLES FROM  
PROSPECTOR SQUARE, PARK CITY, UTAH

PARAMETER	TRUE VALUE	AVERAGE	95% CONFIDENCE INTERVAL
Aluminum	50	52.26	42.3-62.3
Arsenic	10	9.92	7.72-12.1
Beryllium	10	9.89	8.61-11.2
Cadmium	2.5	2.38	1.99-2.77
Cobalt	10	9.90	8.55-11.3
Chromium	10	9.81	7.77-11.8
Copper	10	10.02	8.78-11.3
Iron	10	10.09	8.33-11.9
Mercury	.5	.490	.338-.642
Manganese	10	9.92	8.76-11.1
Nickel	10	9.99	8.41-11.6
Lead	10	9.96	8.28-11.6
Selenium	2.5	2.31	1.50-3.12
Vanadium	25	25.6	21.3-29.9
Zinc	10	10.07	8.59-11.5

Statistics using sample preparation instructions (dil: 1:10)

U.S. EPA QC sample used - Trace Metal I, 1990, WP 386.

All values are expressed as  $\mu\text{g/l}$ .

PEFORMANCE SAMPLE COMPARISON (ug/l)

	TRUE VALUE	CLP	COMMENT	STATE	COMMENT
Aluminum	50	90u	*	<400	*
Arsenic	10	9.4	+	8.0	+
Beryllium	10	10	+	9.0	+
Cadmium	2.5	2.7	+	3.0	+
Cobalt	10	25u	*	<20	*
Chromium	10	17	51% diff	10	+
Copper	10	[17]	*	<20	*
Iron	10	[47]	*	<20	*
Mercury	0.5	0.35	+	0.3	50% diff
Manganese	10	[10]	+	9.0	+
Nickel	10	22u	*	10	+
Lead	10	10	+	10	+
Selenium	2.5	2.5	+	4.0	46% diff
Vanadium	25	[13]	*	-	NR
Zinc	10	48	*	<30	*

\*- Instrument detection limits (IDL) greater than the spike concentrations. Calibration linearity at IDL tends to be questionable since no standards are analyzed at those low concentrations. (i.e. CLP results for iron and zinc).

+- Results within 25% of each other.

[]- Results reported are above the instrument detection limits, but below the contract required detection limits.

When comparing the results from the State of Utah to the Contract Laboratory Program (CLP), the following calculation was used, (which is used to determine difference in duplicate samples from the CLP users guide),  $((s-d)/((s+d)/2)) \times 100$  where s=sample and d=duplicate.

The State of Utah did not analyze the following elements; antimony, thallium, and vanadium. The percent difference for samples and duplicates should fall within 25% difference of each other for duplicates on in house samples.

SAMPLING ROUND III

U.S. ENVIRONMENTAL PROTECTION AGENCY  
GROUNDWATER DATA

## EPA-GW-III

TABLE 1  
 INORGANIC ANALYTICAL RESULTS, GROUND AND DRAIN WATERS ( $\mu\text{g/l}$ )  
 PROSPECTOR SQUARE, PARK CITY, UTAH  
 CASE 9054/3671-H

SAMPLE #	PS-MW-1D	PS-MW-2S	PS-MW-2D	PS-MW-3	PS-MW-4
TRAFFIC #	MHL-424	MHL-426	MHL-423	MHL-427	MHL-429
LOCATION	DEEP W OF SITE	NW BDRY	DEEP SW OF SITE	ONSITE N	ONSITE S
Aluminum	100u	100u	100u	100u	100u
Antimony	25u	25u	25u	25u	25u
Arsenic	3u	3u	3u	3u	3u
Barium	[60]	[51]	[53]	[63]	45u
Beryllium	4u	4u	4u	4u	4u
Cadmium	0.5u	1.0e	0.5u	0.5u	0.5u
Calcium	248000je	220000je	67500je	153000je	220000je
Chromium	9uje	9uje	9uje	9uje	9uje
Cobalt	9u	9u	9u	9u	9u
Copper	12u	[20]	[12]	12u	26
Iron	100u	100u	100u	100u	259
Lead	2u	[2.3]	[8.2]	[3.2]	2u
Cyanide	0.01u	0.01u	0.01u	0.01u	0.01u
Magnesium	47600je	42100je	18100je	29500je	38200je
Manganese	[14]je	80je	8uje	8uje	2750je
Mercury	0.2jr	0.4jr	0.2ujr	0.4jr	0.2ujr
Nickel	[13]	7u	7u	7u	[9.5]
Potassium	[2500]	[2200]	[1000]	[2300]	6600
Selenium	2u	2u	2u	2u	2uj*
Silver	8u	8u	8u	8u	8u
Sodium	83600je	48000je	9370je	104000je	71400je
Thallium	7u	7u	7u	70u	7u
Vanadium	[20]	[17]	10u	[12]	[21]
Zinc	20u	20u	20u	20u	361

[] - Compound is present and was detected. However, the quantity is below the contract required detection limit.

u - The material was analyzed for, but was not detected. The associated numerical value is the estimated sample quantitation limit.

uj - Detection limit is estimated because quality control criteria were not met.

j - The associated numerical value is an estimated quantity because the amount detected is below the required limits or because quality control criteria were not met.

r - Quality control indicates that data is not usable (compound may or may not be present). Resampling and reanalysis is necessary for verification.

je - Indicates a value estimated or nor reported due to presence of interference. (Used when serial dilutions results are not within required limits).

jr - Indicates spike recovery is not within control limits. Indicates the value reported is an estimation.

j\* - Indicates duplicate analysis is not within control limits. Indicates the value reported is an estimation.

e - (itself) indicates a value estimated due to the presence of interference (low spike recovery during AA analysis).

TABLE 1  
 INORGANIC ANALYTICAL RESULTS, GROUND AND DRAIN WATERS ( $\mu\text{g/l}$ )  
 PROSPECTOR SQUARE, PARK CITY, UTAH  
 CASE 9054/3671-H

SAMPLE #	PS-MW-5S MHL-435	PS-MW-5D MHL-436	PS-MW-6 MHL-430	PS-MW-7S MHL-431	PS-MW-7D MHL-432	PS-MW-8 MHL-428
TRAFFIC #						
LOCATION	ONSITE	ONSITE	ONSITE	ONSITE	ONSITE	ONSITE
Aluminum	100u	100u	100u	[150]	100u	100u
Antimony	25u	25u	25u	25u	25u	25u
Arsenic	3u	3u	3u	3u	3u	3u
Barium	45u	[78]	45u	[88]	45u	45u
Beryllium	4u	4u	4u	4u	4u	4u
Cadmium	0.5u	0.5u	5.4	24	0.5u	45
Calcium	199000je	108000je	198000je	220000je	41800je	183000je
Chromium	9uje	9u	9uje	9uje	9uje	9uje
Cobalt	9u	9u	9u	9uje	9u	9u
Copper	12u	12u	[14]	[14]	12u	[19]
Iron	100u	100u	100u	151	100u	100u
Lead	10	[3]	[2.6]	12	[3.4]	[2.9]
Cyanide	0.01u	0.01u	0.01u	0.01u	0.01u	0.01u
Magnesium	36500je	25900je	27300je	27400je	11000je	26100je
Manganese	107je	487je	80je	29je	162je	114je
Mercury	0.4jr	0.2jr	0.3jr	0.4jr	0.2ujr	0.3jr
Nickel	7u	7u	7u	[7.7]	7u	7u
Potassium	[2300]	[1400]	[30000]	5100	500u	5800
Selenium	20u	2u	2u	2u	2u	2u
Silver	8u	8u	8u	8u	8u	8u
Sodium	40800je	15000je	33800je	46600je	10300je	37400je
Thallium	7u	7u	7u	7u	7u	7u
Vanadium	[13]	10u	[14]	[15]	10u	[13]
Zinc	74	20u	1060	2180	20u	2160

[ ] - Compound is present and was detected. However, the quantity is below the contract required detection limit.

u - The material was analyzed for, but was not detected. The associated numerical value is the estimated sample quantitation limit.

uj - Detection limit is estimated because quality control criteria were not met.

j - The associated numerical value is an estimated quantity because the amount detected is below the required limits or because quality control criteria were not met.

r - Quality control indicates that data is not usable (compound may or may not be present). Resampling and reanalysis is necessary for verification.

je - Indicates a value estimated or nor reported due to presence of interference. (Used when serial dilutions results are not within required limits).

jr - Indicates spike recovery is not within control limits. Indicates the value reported is an estimation.

j\* - Indicates duplicate analysis is not within control limits. Indicates the value reported is an estimation.

e - (itself) indicates a value estimated due to the presence of interference (low spike recovery during AA analysis).

TABLE 1  
 INORGANIC ANALYTICAL RESULTS, GROUND AND DRAIN WATERS ( $\mu\text{g/l}$ )  
 PROSPECTOR SQUARE, PARK CITY, UTAH  
 CASE 9054/3671-H

SAMPLE #	PS-MW-9	PS-MW-10	PS-MW-11S	PS-MW-11D	PS-MW-13	PS-MW-14
TRAFFIC #	MHL-433	MHL-441	MHL-437	MHL-438	MHL-422	MHL-425
LOCATION	ONSITE E	E OF SITE	N OF SITE	NE OF SITE	N OF SITE	N OF SITE
Aluminum	100u	100u	100u	100u	641	100u
Antimony	25u	25u	25u	25u	25u	25u
Arsenic	3u	9.0	3u	3u	3u	3u
Barium	45u	[88]	45u	[48]	[62]	[84]
Beryllium	4u	4u	4u	4u	4u	4u
Cadmium	28e	8.9e	1.2e	1.5e	0.5u	0.5u
Calcium	173000je	113000je	188000je	88800je	256000je	229000je
Chromium	9uje	9uje	9uje	9uje	72je	88je
Cobalt	9u	9u	9u	9u	9u	9u
Copper	12u	[22]	[13]	12u	12u	[20]
Iron	595	100u	115	100u	100u	100u
Lead	6.3	20	[2.9]	11	5	8.5s
Cyanide	0.01u	0.01u	11	0.01u	0.01u	0.01u
Magnesium	29100je	32800je	34800je	22800je	377uje	377uje
Manganese	889je	389je	141je	482je	8uje	8uje
Mercury	0.3jr	0.2jr	0.3jr	0.2jr	0.2jr	0.2jr
Nickel	7u	7u	7u	7u	7u	[13]
Potassium	[1900]	[1200]	[1300]	[1200]	5400	6100
Selenium	2u	2u	2u	2u	2u	2u
Silver	8u	8u	8u	8u	8u	8u
Sodium	47400je	33800je	27900je	14700je	13100je	29100je
Thallium	7u	7u	7u	7u	7 u	7u
Vanadium	[13]	[11]	[137]	10u	[13]	[11]
Zinc	20u	614	20u	20u	20u	20u

[] - Compound is present and was detected. However, the quantity is below the contract required detection limit.

u - The material was analyzed for, but was not detected. The associated numerical value is the estimated sample quantitation limit.

uj - Detection limit is estimated because quality control criteria were not met.

j - The associated numerical value is an estimated quantity because the amount detected is below the required limits or because quality control criteria were not met.

r - Quality control indicates that data is not usable (compound may or may not be present). Resampling and reanalysis is necessary for verification.

je - Indicates a value estimated or nor reported due to presence of interference. (Used when serial dilutions results are not within required limits).

jr - Indicates spike recovery is not within control limits. Indicates the value reported is an estimation.

j\* - Indicates duplicate analysis is not within control limits. Indicates the value reported is an estimation.

e - (itself) indicates a value estimated due to the presence of interference (low spike recovery during AA analysis).

TABLE 1  
 INORGANIC ANALYTICAL RESULTS, GROUND AND DRAIN WATERS ( $\mu\text{g/l}$ )  
 PROSPECTOR SQUARE, PARK CITY, UTAH  
 CASE 9054/3671-H

SAMPLE #	PS-MW-16 MHL-439	PS-MW-17 MHL-440	PS-MW-19 MHL-442	PS-SW-1 MHL-434
TRAFFIC #	MW-11D	RINSATE		DRAIN E OF PARK
LOCATION	DUPLICATE	BLANK	PE	
Aluminum	100u	100u	100u	100u
Antimony	25u	25u	25u	25u
Arsenic	3u	3u	8.2	5.2
Barium	[48]	45u	45u	45u
Beryllium	4u	4u	9.4	4u
Cadmium	0.5u	2.4	2.4	24
Calcium	87900je	718je	718u	197000je
Chromium	9uje	9uje	[9.5]je	9uje
Cobalt	9u	9u	[9.2]je	9u
Copper	[19]	12u	[20]	[16]
Iron	100u	100u	100u	491
Lead	[4.5]	5.6a	13	11
Cyanide	0.01u	0.01u	0.01u	0.01u
Magnesium	22600je	277uje	377uje	28700je
Manganese	478je	8uje	8uje	875je
Mercury	0.8jr	0.8jr	0.75njr	0.3jr
Nickel	[7.4]	7u	7u	7u
Potassium	[1200]	500u	500u	[4000]
Selenium	2u	2u	2u	2u
Silver	8u	8u	8u	8u
Sodium	14400je	11660je	1166uje	66300je
Thallium	7u	7u	7u	7u
Vanadium	10u	10u	[16]	[17]
Zinc	20u	20u	20u	2050

[ ] - Compound is present and was detected. However, the quantity is below the contract required detection limit.

u - The material was analyzed for, but was not detected. The associated numerical value is the estimated sample quantitation limit.

uj - Detection limit is estimated because quality control criteria were not met.

j - The associated numerical value is an estimated quantity because the amount detected is below the required limits or because quality control criteria were not met.

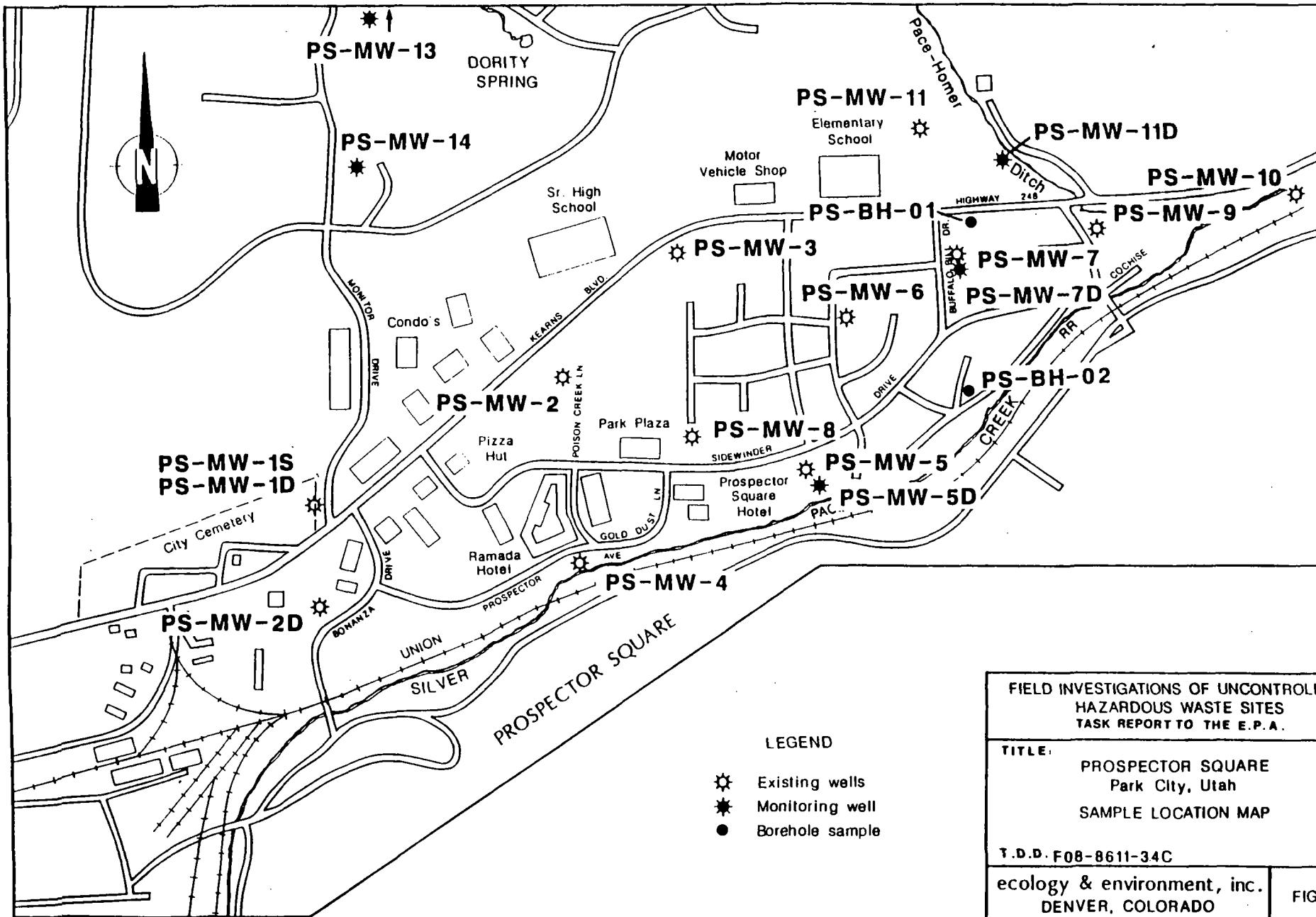
r - Quality control indicates that data is not usable (compound may or may not be present). Resampling and reanalysis is necessary for verification.

je - Indicates a value estimated or nor reported due to presence of interference. (Used when serial dilutions results are not within required limits).

jr - Indicates spike recovery is not within control limits. Indicates the value reported is an estimation.

j\* - Indicates duplicate analysis is not within control limits. Indicates the value reported is an estimation.

e - (itself) indicates a value estimated due to the presence of interference (low spike recovery during AA analysis).



FIELD INVESTIGATIONS OF UNCONTROLLED HAZARDOUS WASTE SITES TASK REPORT TO THE E.P.A.	
<b>TITLE:</b> PROSPECTOR SQUARE Park City, Utah	
SAMPLE LOCATION MAP	
T.D.D. FOB-8611-34C	
ecology & environment, inc. DENVER, COLORADO	
FIG. 2	
Date: 10/87	Drawn by: RSM
Scale: 1" - 665'	

SAMPLING ROUND IV

U.S. ENVIRONMENTAL PROTECTION AGENCY  
GROUNDWATER DATA

EPA-GW-IV

DRAFT

PROSPECTOR SQUARE  
PARK CITY, UTAH  
GROUND WATER ANALYTICAL RESULTS  
FOURTH ROUND SAMPLING  
APRIL, 1988  
µg/l  
CASE #9286/3757H

SAMPLE NUMBER	PS-MW-1S	PS-MW-1D	PS-MW-2D	PS-MW-2	PS-MW-3
TRAFFIC NUMBER	MHL-601	MHL-606	MHL-607	MHL-608	MHL-616
LOCATION	BACKGROUND	BACKGROUND	BACKGROUND	ONSITE	ONSITE
Aluminum	100u	100u	100u	100u	100u
Antimony	17u	17u	17u	17u	17u
Arsenic	2u	2u	2.7u	2u	2u
Barium	[98]	390jr	[57]	[54]	[70]
Beryllium	2u	2u	2u	2u	2u
Cadmium	1.1u	1.1u	1.1u	1.1u	1.1u
Calcium	294,000	230,000	65,800	210,000	157,000
Chromium	4u	4u	4u	4u	[4.5]
Cobalt	6u	6u	6u	6u	6u
Copper	[16]	[12]	[10]	[11]	34
Cyanide	10u	10u	10u	10u	10u
Iron	100u	138jr	192jr	100u	100u
Lead	30u	3u	6.5jr	3u	3u
Magnesium	51,800	44,500	18,200	40,300	31,300
Manganese	28	[14]	7u	[7.3]	[7.8]
Mercury	0.2u	0.2u	0.2u	0.2u	0.2u
Nickel	11u	11u	11u	11u	11u
Potassium	[3500]	[1600]	[500]	[1400]	[1600]
Selenium	2u	2u	2u	2u	2u
Silver	5u	15jr	5u	5u	5u
Sodium	25,100	80,200	9,300	48,600	10,300
Thallium	70u	7u	7u	7u	7u
Vanadium	4u	4u	4u	4u	4u
Zinc	[14]	48jr	[9.1]	7u	9.1jr
Alkalinity	135	102	110	112	142
Chloride	860	437	40	332	292
Sulfate	260	238	780	226	490

u - The material was analyzed for, but was not detected. The associated numerical value is the estimated sample quantitation limit.

[] - Compound is present and was detected. However, the quantity is below the contract required detection limit.

jr - Indicates spike recovery is not within control limits. Indicates the value reported is an estimation.

**DRAFT**

PROSPECTOR SQUARE  
PARK CITY, UTAH  
GROUND WATER ANALYTICAL RESULTS  
FOURTH ROUND SAMPLING  
APRIL, 1988  
µg/l  
CASE #9286/3757H

SAMPLE NUMBER	PS-MW-4	PS-MW-5	PS-MW-5D	PS-MW-6	PS-MW-7	PS-MW-7D
TRAFFIC NUMBER	MHL-609	MHL-610	MHL-611	MHL-615	MHL-612	MHL-613
LOCATION	ONSITE	ONSITE	ONSITE	ONSITE	ONSITE	ONSITE
Aluminum	100u	100u	100u	100u	100u	100u
Antimony	17u	17u	17u	17u	17u	17u
Arsenic	2u	2u	2u	2u	2u	2u
Barium	[20]	[29]	[61]	[20]	[18]	[39]
Beryllium	2u	2u	2u	2u	2u	2u
Cadmium	5.5u	3.6jr	1.1u	5.5u	5.5u	1.1u
Calcium	177000	165000	99800	208000	216000	37200
Chromium	4u	[5.2]	4u	[5.1]	4u	4u
Cobalt	6u	6u	6u	6u	6u	6u
Copper	[12]	[12]	[14]	[18]	[14]	9u
Cyanide	18	16	10u	10u	10u	10u
Iron	100u	121jr	100u	100u	100u	100u
Lead	3u	3u	3u	3u	3u	5.4jr
Magnesium	30,700	29,300	24,000	29500	27200	10000
Manganese	44	47	82	63	[14]	383
Mercury	0.2u	0.2u	0.2u	0.2u	0.2u	0.2u
Nickel	11u	[13]	11u	11u	11u	11u
Potassium	5300	[2500]	[700]	[2900]	[3500]	500u
Selenium	2u	2u	2u	2u	2u	2u
Silver	5u	5u	5u	5u	5u	5u
Sodium	50,900	46,000	14,200	38,500	47,200	9420
Thallium	7u	7u	7u	7u	7u	7u
Vanadium	4u	4u	4u	4u	4u	4u
Zinc	2290jr	1780jr	[8.8]	1540jr	2030jr	[8.1]
Alkalinity	55.0	58.0	108	50	608	115
Chloride	145	125	36.0	112	112	120
Sulfate	225	484	258	990	212	31

u - The material was analyzed for, but was not detected. The associated numerical value is the estimated sample quantitation limit.

[] - Compound is present and was detected. However, the quantity is below the contract required detection limit.

jr - Indicates spike recovery is not within control limits. Indicates the value reported is an estimation.

# DRAFT

PROSPECTOR SQUARE  
PARK CITY, UTAH  
GROUND WATER ANALYTICAL RESULTS  
FOURTH ROUND SAMPLING  
APRIL, 1988  
µg/l  
CASE #9286/3757H

SAMPLE NUMBER	PS-MW-8	PS-MW-9	PS-MW-10	PS-MW-11	PS-MW-11D
TRAFFIC NUMBER	MHL-614	MHL-621	MHL-624	MHL-629	MHL-630
LOCATION	ONSITE	DNGRDNT	DNGRDNT	DNGRDNT	DNGRDNT
Aluminum	100u	100u	100u	100u	100u
Antimony	17u	17u	17u	17u	17u
Arsenic	2u	2.4	[9.6]	2u	2.6
Barium	[20]	[40]	[88]	717jr	[56]
Beryllium	2u	2u	2u	2u	2u
Cadmium	20jr	1.1u	5.0jr	1.1u	1.1u
Calcium	93,000	200,000	141,000	165,000	81,000
Chromium	4u	4u	[4.1]	4u	4u
Cobalt	6u	6u	6u	6u	6u
Copper	[15]	[23]	[22]	25	29
Cyanide	14	10u	10u	10u	10u
Iron	100u	918jr	114jr	100u	118jr
Lead	3u	3u	31jr	3u	3.1jr
Magnesium	27900	33600	38800	30200	20900
Manganese	115	1110	1220	118	244
Mercury	0.2u	0.2u	0.2u	0.2u	0.2u
Nickel	11u	11u	11u	11u	11u
Potassium	[4800]	[1600]	[1300]	[500]	500u
Selenium	2u	2u	2u	2u	2u
Silver	[6.7]	5u	5u	5u	5u
Sodium	42900	59000	40900	24200	13900
Thallium	7u	7u	7u	7u	7u
Vanadium	4u	4u	4u	4u	4u
Zinc	2780jr	[16]	1930jr	38jr	[13]
Alkalinity	50.0	195	215	160	652
Chloride	170	207	95	167	35
Sulfate	512	189	251	244	122

u - The material was analyzed for, but was not detected. The associated numerical value is the estimated sample quantitation limit.

[] - Compound is present and was detected. However, the quantity is below the contract required detection limit.

jr - Indicates spike recovery is not within control limits. Indicates the value reported is an estimation.

# DRAFT

PROSPECTOR SQUARE  
PARK CITY, UTAH  
GROUND WATER ANALYTICAL RESULTS  
FOURTH ROUND SAMPLING  
APRIL, 1988  
µg/l  
CASE #9286/3757H

SAMPLE NUMBER	PS-MW-13	PS-MW-13	PS-DR-1	PS-TB-1
TRAFFIC NUMBER	MHL-632	MHL-631	MHL-620	MHL-602
LOCATION	FIELD BLANK	DUPLICATE	DOWNGRADIENT	TRIP BLANK
Aluminum	100u	100u	100u	100u
Antimony	17u	17u	17u	17u
Arsenic	2u	2u	2u	2u
Barium	5u	[51]	[16]	334jr
Beryllium	2u	2u	2u	2u
Cadmium	11u	1.1u	12jr	1.1u
Calcium	500u	85800 ✓	215000	500u
Chromium	4u	4u	[5.0]	4u
Cobalt	6u	6u	6u	6u
Copper	[9.5]	[21]	[19]	[14]
Cyanide	10u	10u	10u	NR
Iron	100u	100u	287	100u
Lead	3.1jr	3.5jr	4.4jr	3u
Magnesium	500u	22200	32,600	500u
Manganese	7u	259	531	7u
Mercury	0.2u	0.2u	0.2u	0.2u
Nickel	11u	11u	11u	11u
Potassium	500u	500u	[3400]	500u
Selenium	2u	2u	2u	2u
Silver	5u	5u	5u	5u
Sodium	[692]	14700	47300	597u
Thallium	7u	7u	7u	7u
Vanadium	4u	4u	4u	4u
Zinc	[9.4]	[9.4] ✓	2860jr	7u
Alkalinity	2u	155 ✓	80.0	NR
Chloride	9.50	39	197	NR
Sulfate	10u	122	522	NR

u - The material was analyzed for, but was not detected. The associated numerical value is the estimated sample quantitation limit.

[] - Compound is present and was detected. However, the quantity is below the contract required detection limit.

jr - Indicates spike recovery is not within control limits. Indicates the value reported is an estimation.

NR - Compound not analyzed for.

SAMPLING ROUND I

U.S. ENVIRONMENTAL PROTECTION AGENCY  
SURFACE WATER DATA

EPA-SW-I

DRAFT

TABLE 1  
PROSPECTOR SQUARE  
INORGANIC ANALYSIS FOR SURFACE WATER SAMPLES  
PARK CITY, UTAH (ug/l total)  
APRIL 29, 1987

SAMPLE #	PS-SW-1	PS-SW-2	PS-SW-3	PS-SW-4	PS-SW-5	PS-SW-6
TRAFFIC #	MHG-651	MHG-646	MHG-653	MHG-781	MHG-654	MHG-649
LOCATION	UPGRDNT	UPGRDNT	UPGRDNT	DNGRDNT	DNGRDNT	DUPLICATE
Aluminum	140u	140u	1360	1370	420	140u
Antimony	60u	60u	60u	60u	60u	60u
Arsenic	10	10u	27	17	12	10u
Barium	70u	70u	[80]	70u	70u	70u
Beryllium	3u	3u	3u	3u	3u	3u
Cadmium	4u	4u	4u	4u	4u	4u
Calcium	95,700	105,000	76,900	78,200	120,000	104,000
Chromium	10u	10u	10u	10u	10u	10u
Cobalt	30u	30u	30u	30u	30u	30u
Copper	11u	[20]	54	40	26	[19]
Iron	120	60u	2350	1860	810	60u
Lead	5u	24b	580	330	166	17
Cyanide	10u	10u	10u	10u	--	10u
Magnesium	31,100	29,800	16,200	15,700	26,600	29,500
Manganese	129	63	278	309	382	65
Mercury	.2u	.2u	.2u	.2u	.2u	.2u
Nickel	24u	24	24u	24u	24u	24u
Potassium	[1900]	[1700]	[3200]	[3300]	[2400]	[1800]
Selenium	5ur	5ur	5ur	5ur	5ur	5ur
Sodium	17,500	22,800	97,000	563,000	47,000	23,300
Silver	92	119	91*r	10ur	103	116*r
Thallium	10ur	10ur	10ur	10ur	10ur	10ur
Tin	50	40u	40ur	40u	40u	40u
Vanadium	20u	20u	20ur	20u	20u	20u
Zinc	29	73	871	525	755	50

nr - Not required by contract at this time.

u - Indicates element was analyzed for but not detected.

r - Data is unusable due to spike recovery values.

\* - Indicates duplicate analysis is not within control limits.

[] - Element was identified in the sample, but concentration is less than CRDL.

b - Compound was detected in the blank. Quantity reported is >5x the amount found in the blank.

**DRAFT**  
 TABLE 2  
 PROSPECTOR SQUARE  
 INORGANIC ANALYSIS FOR SURFACE WATER SAMPLES  
 PARK CITY, UTAH (ug/l dissolved)  
 APRIL 29, 1987

SAMPLE #	PS-SW-1	PS-SW-2	PS-SW-3	PS-SW-4	PS-SW-5	PS-SW-6	PS-SW-7
TRAFFIC #	MHG-657	MHG-658	MHG-644	MHG-652	MHG-779	MHG-655	MHG-650
LOCATION	UPGRDNT	UPGRDNT	UPGRDNT	DNGRDNT	DNGRDNT	DUPPLICATE	BLANK
Aluminum	140u	140u	140u	140u	140u	140u	140u
Antimony	60u	60u	60u	60u	60u	60u	60u
Arsenic	10u	10u	10u	10u	10u	10u	10u
Barium	70u	70u	70u	[80]	70u	70u	70u
Beryllium	3u	3u	3u	3u	3u	3u	3u
Cadmium	4u	4u	4u	4u	4u	4u	4u
Calcium	94,200	107,000	78,400	83,000	123,000	104,000	1900u
Chromium	10u	10u	10u	10u	10u	10u	10u
Cobalt	30u	30u	20u	30u	30u	30u	30u
Copper	11u	[13]	30	[23]	[16]	[14]	[18]
Iron	60u	110	60u	60u	60u	120	60u
Lead	5u	27s	7	9	8	27	5u
Magnesium	29,800	30,500	5,500	17,100	27,200	29,300	1400u
Manganese	158	72	122	259	353	73	11u
Mercury	.2u	.2u	.4u	.2u	.2u	.2	.2u
Nickel	24u	24u	24u	24u	24u	24u	24u
Potassium	[1800]	[1700]	[8000]	[2700]	[2400]	[1800]	[1400]u
Selenium	5ur	5ur	5ur	5ur	5ur	5ur	5ur
Sodium	17,300	23,300	95,800	106,000	46,700	25,100	1500u
Silver	99*r	10ur*	117	95*r	10ur	107*r	116r
Thallium	10ur	10ur	10ur	10ur	10ur	10ur	10ur
Tin	40u	40u	40u	40u	40u	40u	40u
Vanadium	20u	20u	20u	20u	20u	20u	20u
Zinc	32	63	62	68	559	76	15u

u - Indicates element was analyzed for but not detected.

r - Data is unusable, due to spike recovery.

\* - Indicates duplicate analysis is not within control limits.

[] - Element was identified in the sample, but concentration is less than CRDL.

s - Indicates value determined by method of standard addition.

TABLE 3  
PROSPECTOR SQUARE  
INORGANIC ANALYSIS FOR SEDIMENT SAMPLES  
PARK CITY, UTAH (mg/kg)  
APRIL 29, 1987

**DRAFT**

	PS-SE-1 NOT TAKEN	PS-SE-2 MHG-647 UPGRDNT	PS-SE-3 MHG-645 UPGRDNT	PS-SE-4 MHG-782 LATERAL	PS-SE-5 MHG-780 DNGRDNT	PS-SE-6 MHG-648 DUPLICATE
Aluminum	20,000	22,300	25,00	17,500	20,800	
Antimony	105ur	77r	130r	154r	72ur	
Arsenic	159	2173	229	256	94	
Barium	[77]r	263r	[200]r	213r	[169]r	
Beryllium	5.3ur	2.3ur	3.5ur	2.6ur		
Cadmium	23r	43r	33r	45r	17r	
Calcium	36,800	86,600	26,300	30,600	27,900	
Chromium	44r	186r	52r	50r	39r	
Cobalt	53ur	23ur	35ur	26ur	36ur	
Copper	293r	280r	191r	343r	167r	
Iron	24,500	54,500	30,600	36,400	25,500	
Lead	3786	5900	3910	5960	2440	
Cyanide	nr	nr	nr	nr	nr	
Magnesium	9,900	27,500	14,500	10,900	9780	
Manganese	1430r	5020r	1430r	1570r	1790	
Mercury	1.1	16	24	8.5	.73	
Nickel	42u	19u	28ur	20u	29u	
Potassium	[3180]	4870	[4950]	[3160]	[4590]	
Selenium	8.8u	13	5.9u	6.85	6u	
Sodium	2650u	1160u	1770u	1280u	1810u	
Silver	18u	18	28r	31r	12u	
Thallium	18u	7.7u	12u	8.5u	12u	
Tin	71ur	31ur	47ur	34ur	48ur	
Vanadium	35ur	262r	[48]r	[38]r	[36]r	
Zinc	4710	7390	6130	8320	3670	
% Solids	28%	64%	42%	58%	41%	

nr - Not required by contract at this time.

u - Indicates element was analyzed for but not detected.

r - Data is unusable due to spike recovery.

[ ] - Element was identified in the sample, but concentration is less than CRDL.

\* - Indicates duplicate analysis is not within control limits.

SAMPLING ROUND II

U.S. ENVIRONMENTAL PROTECTION AGENCY  
SURFACE WATER DATA

**DRAFT COPY**

EPA-SW-II

**DRAFT COPY**

PROSPECTOR SQUARE  
PARK CITY, UTAH  
SECOND ROUND SURFACE WATER DATA  
JULY, 1987  
(ug/l)

SAMPLE NUMBER	PS-SV-1	PS-SV-1	PS-SV-2	PS-SV-2	PS-SV-3	PS-SV-3
TRAFFIC NUMBER	MHG-693	MHG-694	MHG-695	MHG-697	MHG-656	MHG-686
TYPE	TOTAL	DSSLVD	TOTAL	DSSLVD	TOTAL	DSSLVD
Aluminum	[71]	[16]	[32]	[20]	[60]	[32]
Antimony	25u	25u	25u	25u	25u	25u
Arsenic	18	17	12	11	10u	10u
Barium	[22]	[22]	[30]	[28]	[51]	[49]
Beryllium	1u	1u	1u	1u	1u	1u
Cadmium	4u	4u	4u	4u	4u	4u
Calcium	118,000	120,000	120,000	120,000	78,900	79,400
Chromium	4u	4u	4u	4u	4u	4u
Cobalt	9u	9u	9u	9u	9u	9u
Copper	56	28	[16]	[11]	[11]	[6.1]
Cyanide	10u	NR	10u	NR	10u	NR
Iron	[90]	24u	[65]	24u	192	[29]
Lead	5u	5u	13	14	42	5u
Magnesium	35,400	36,300	33,200	33,800	17,200	17,300
Manganese	86	60	33	23	28	18
Mercury	0.2u	0.2u	0.2u	0.2u	0.2u	0.2u
Nickel	8u	8u	8u	8u	8u	8u
Potassium	[1930]	[1850]	[1760]	[1900]	[3010]	[3180]
Selenium	5u	5u	5u	5u	5u	5u
Silver	4u	4u	4u	4u	4u	4u
Sodium	9400	8780	16,100	16,800	76,400	76,500
Thallium	10u	10u	10u	10u	10u	10u
Tin	22u	22u	22u	22u	22u	22u
Vanadium	7u	7u	7u	7u	7u	7u
Zinc	23	[16]	28	23	77	38

u - The material was analyzed for, but was not detected. The associated numerical value is the estimated sample quantitation limit.

[] - Indicated concentration detected at less than contract required detection limits.

NR - Not analyzed for.

# DRAFT COPY

PROSPECTOR SQUARE  
 PARK CITY, UTAH  
 SECOND ROUND SURFACE WATER DATA  
 JULY, 1987  
 (ug/l)

SAMPLE NUMBER	PS-SV-4	PS-SV-4	PS-SV-5	PS-SV-5	PS-SV-6	PS-SV-6
TRAFFIC NUMBER	MHG-688	MHG-687	MHG-689	MHG-690	MHG-689	MHG-688
	DSSLVD	TOTAL	TOTAL	DSSLVD	DSSLVD	TOTAL
Aluminum	[17]	[21]	[198]	[26]	[19]	[22]
Antimony	25u	25u	25u	[25]	25u	25u
Arsenic	10u	10u	12	10u	11	12
Barium	[60]	[57]	[46]	[46]	[29]	[30]
Beryllium	1u	1u	1u	1u	1u	1u
Cadmium	17	12	7.1	6	4u	4u
Calcium	238,000	236,000	225,000	218,000	120,000	119,000
Chromium	4u	4u	4u	4u	4u	4u
Cobalt	9u	9u	9u	9u	9u	9u
Copper	[10]	[7.1]	[16]	6u	[11]	[18]
Cyanide	NR	10u	10u	NR	NR	10u
Iron	[27]	[94]	759	[80]	[29]	[73]
Lead	50u	50u	161	6.2	5u	13
Magnesium	63,100	62,400	34,700	34,400	33,600	33,300
Manganese	2970	2860	1050	980	23	31
Mercury	0.2u	0.4u	0.3	0.2u	0.2u	0.2u
Nickel	[8.5]	8u	[8.6]	8u	8u	8u
Potassium	[4240]	[4200]	[3980]	[3800]	[1790]	[1790]
Selenium	50u	50u	5u	5u	5u	5u
Silver	4u	[4.2]	[4]	4u	4u	4u
Sodium	40,600	39,800	49,400	48,000	16,800	16,200
Thallium	10u	10u	10u	10u	10u	10u
Tin	22u	22u	22u	22u	22u	22u
Vanadium	7u	7u	7u	7u	7u	7u
Zinc	3500	3410	2610	2380	24	26

u - The material was analyzed for, but was not detected. The associated numerical value is the estimated sample quantitation limit.

[] - Indicated concentration detected at less than contract required detection limits.

NR - Not analyzed for.

PROSPECTOR SQUARE  
PARK CITY, UTAH  
SECOND ROUND, SEDIMENT DATA  
JULY, 1987  
mg/kg

SAMPLE NUMBER	PS-SE-2	PS-SE-3	PS-SE-4	PS-SE-5	PS-SE-6
TRAFFIC NUMBER	MHG-871	MHG-872	MHG-873	MHG-874	MHG-875
LOCATION	P/H DITCH	UPGRDNT	DNGRDNT	DNGRDNT	DUP SE-2
Aluminum	3540	43400	9640	3730	3320
Antimony	[38]	366	20uj	184	[34]
Arsenic	54	514	25	385	47
Barium	[58]	[682]	[93]	[96]	[44]
Beryllium	0.85u	[4]	[0.9]	0.77u	0.98u
Cadmium	14	123	14	63	11
Calcium	12,000	158,000	9260	27500	9080
Chromium	8.7j	115j	15j	14j	[5.3]j
Cobalt	7.6u	[38]	[9.7]	6.9u	8.8u
Copper	154	1200	58	400	117
Iron	6370	86300	13000	24000	5240
Lead	1640	19300	670	5000	1270
Magnesium	[2580]	65000	[3670]	8860	[2440]
Manganese	431	4090	2050	1650	523
Mercury	6.6	14j	1.5j	7.2j	8.4j
Nickel	[8.8]	[99]j	[17]j	[14]	[8.9]j
Potassium	[642]	[8150]	[1520]	[569]	[672]
Selenium	4.2u	18u	4u	38u	4.9u
Silver	12j	110	[5.9]j	35j	[9.5]j
Sodium	924u	3890u	865u	838uj	1070uj
Thallium	8.5u	36u	7.9u	7.7u	9.8u
Tin	19u	79u	17uj	17u	22u
Vanadium	[8.8]	[127]	[23]	[12]	6.9u
Zinc	2330	22900	3130	12800	1660
Cyanide	0.85uj	10j	0.79uj	0.77u	0.98u

[ ] - Compound is present and was detected. However, the quantity is below the contract required detection limit.

u - The material was analyzed for, but was not detected. The associated numerical value is the estimated sample quantitation limit.

uj - Detection limit is estimated because quality control criteria were not met.

j - The associated numerical value is an estimated quantity because the amount detected is below the required limits or because quality control criteria were not met.

SAMPLING ROUND III

U.S. ENVIRONMENTAL PROTECTION AGENCY  
SURFACE WATER DATA

EPA-SW-III

TABLE 1  
 PROSPECTOR SQUARE  
 PARK CITY, UTAH  
 APRIL, 1988  
 INORGANIC ANALYTICAL RESULTS  
 SEDIMENT SAMPLING mg/kg  
 TDO P08-8611-34G  
 CASE #9245

SAMPLE NUMBER TRAFFIC REPORT	PS-SE-2 MHL-619	PS-SE-3 MHL-628	PS-SE-4 MHL-626	PS-SE-5 MHL-623
Aluminum	13,800	10,600	19,900	3,780
Antimony	47.1j	29.9j	8.7uj	120j
Arsenic	143	78.4j	22.9j	165
Barium	215	164	109	73.1
Beryllium	[0.87]	[0.73]	[1.1]	0.28u
Cadmium	28.9	23.6	3.9	96.5
Calcium	48,500	42,900	7,650	26,300
Chromium	59.1j	31.5j	24.6j	14.3j
Cobalt	[11.7]	[6.9]	[7.5]	[6.0]
Cyanide	1.0uj	8.9j	0.75uj	0.70uj
Copper	435j	173j	36.4j	317j
Iron	30,100	21,000	25,700	23,200
Lead	3,340	2,960	164	5290
Magnesium	12,000	14,200	5,940	9550
Manganese	1500	1450	294	1910
Mercury	12	1.8	0.3	3.6
Nickel	19.4	15.8	18.5	[10.2]
Potassium	2330	[1770]	1920	[686]
Selenium	8.3uj	3.6uj	6.0uj	2.2j
Silver	22.8j	15.4j	[2.7]j	31.6j
Sodium	830u	[737]	[644]	2600
Thallium	1.2	0.71u	0.60uj	[0.84]j
Vanadium	64.2	37.2	41.0	[12.2]
Zinc	4890	3670	372	19,000
% Solids	48.2	56.0	66.7	71.4

u - The material was analyzed for, but was not detected. The associated numerical value is the contract required detection limit (CRDL).

j - The associated numerical value is an estimated quantity. Presence of the material is reliable.

uj - QC problems indicate a false negative result may exist.

[] - Compound is present and was detected. However, the quantity is below the contract required detection limit.

TABLE 2  
 PROSPECTOR SQUARE  
 PARK CITY, UTAH  
 APRIL, 1988  
 INORGANIC RESULTS  
 SURFACE WATER SAMPLING  $\mu\text{g/l}$   
 TDD P08-8611-34  
 CASE #9245

SAMPLE NUMBER TRAFFIC REPORT	PS-SW-1 MHL-617	PS-SW-2 MHL-618	PS-SW-3 MHL-627	PS-SW-4 MHL-625	PS-SW-5 MHL-622
Aluminum	100u	100u	100u	100u	100u
Antimony	17u	17u	17u	17u	17u
Arsenic	5.4	5.2	2.0u	28	5.2
Barium	[46]j	[31]j	466j	[66]j	[34]j
Beryllium	2uj	2uj	2uj	2uj	2uj
Cadmium	1.1uj	1.1j	1.1uj	1.1j	1.1uj
Calcium	77,200	91,500	71,100	69,800	97,300
Chromium	4u	4u	4u	4u	4u
Cobalt	6u	6u	6u	6u	6u
Copper	[14]	[10]	[23]	[21]	[22]
Cyanide	10u	10u	10u	10u	19
Iron	121j	152j	100uj	100uj	111j
Lead	17j	11j	3.5j	4.2j	14j
Magnesium	24,900	25,600	14,400	14,200	22,400
Manganese	284	106	260	207	165
Mercury	0.2u	0.2u	0.2u	0.2u	0.2u
Nickel	11u	11u	11u	11u	11u
Potassium	[1500]	[1200]	[1600]	[1900]	[1900]
Selenium	2u	2u	2u	2u	2u
Silver	5uj	5uj	5uj	5uj	[5.5]j
Sodium	17500	19400	112,000	110,000	54,600
Thallium	7uj	7uj	7uj	7uj	7uj
Vanadium	4u	4u	4u	4u	4u
Zinc	[14]j	50j	136j	151j	260j
Chloride	30	49	215	225	135
Sulfate	130	166	68	77.0	184
Alkalinity	172	170	102	100	140

u - The material was analyzed for, but was not detected. The associated numerical value is the contract required detection limit (CRDL).

j - The associated numerical value is an estimated quantity. Presence of the material is reliable.

uj - QC problems indicate a false negative result may exist.

[] - Compound is present and was detected. However, the quantity is below the contract required detection limit.

## SIL-GW-I

Table 1 - Silver Creek Tailings, Park City, Utah

Sample	MW01S	MW01D	MW12	MW04	MW02	MW03	MW08	MW05	MW06	MW07	MW11	MW09	MW10
<b>Sample Date: 08/31/87</b>													
<b>Ground Water Samples</b>													
Aluminum (ug/l)	< 400	< 400	< 400	< 400	< 400	< 400	< 400	< 400	< 400	< 400	< 400	< 400	< 400
T-Arsenic (ug/l)	< 1.1	< 1.1	< 1.1	< 1.1	< 1.1	< 1.1	< 1.1	< 1.1	< 1.2	< 1.1	1.5	6.5	28.0
T-Barium (mg/l)	0.096	0.089	0.052	0.027	0.053	0.100	0.023	0.038	0.025	0.021	0.068	0.053	0.110
Beryllium (ug/l)	< 1	1	< 1	< 1	1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
T-Cadmium (ug/l)	< 1	19	1	6	1	< 1	29	39	35	15	3	< 1	7
Calcium (mg/l)	340	230	67	220	230	180	220	200	240	260	320	200	130
Chloride (mg/l)	924.9	379.9	37.5	132.5	357.4	344.9	155.0	125.0	132.5	110.0	155.0	147.5	92.4
T-Chromium (ug/l)	< 30.0	< 30.0	< 30.0	< 30.0	< 30.0	< 30.0	< 30.0	< 30.0	< 30.0	< 30.0	< 30.0	< 30.0	< 30.0
Cobalt (ug/l)	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20	< 20
T-Copper (ug/l)	< 20.0	< 20.0	< 20.0	< 20.0	< 20.0	< 20.0	< 20.0	< 20.0	< 20.0	< 20.0	< 20.0	< 20.0	< 20.0
Cyanide (mg/l)	< 0.023	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
T-Iron (mg/l)	< 0.020	0.079	0.670	0.290	0.095	< 0.020	< 0.020	0.380	0.160	< 0.020	0.320	0.050	< 0.020
T-Lead (ug/l)	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	30.0
Magnesium (mg/l)	60	44	18	39	44	36	32	34	33	33	59	32	36
T-Manganese (ug/l)	94.0	430.0	43.0	300.0	110.0	8.0	420.0	120.0	440.0	240.0	570.0	1200.0	1100.0
Mercury (ug/l)	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Potassium (mg/l)	3	2	1	7	2	2	7	4	5	6	2	3	3
T-Selenium (ug/l)	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
T-Silver (ug/l)	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Sodium (mg/l)	260	77	12	53	53	110	48	54	42	52	42	64	45
Sulfate (mg/l)	250	240	83	530	210	180	490	500	550	660	500	330	230
T-Zinc (ug/l)	25.0	19.0	40.0	1700.0	26.0	< 15.0	2800.0	2100.0	1100.0	2000.0	18.0	< 15.0	1800.0

MW=Monitoring Well

Analyzed by: State Health Laboratory, Salt Lake City, Utah

Table 1 - Silver Creek Tailings, Park City, Utah

Parameter	DR02	DR01
Aluminum (ug/l)	< 400	< 400
T-Arsenic (ug/l)	4.5	13.5
T-Barium (mg/l)	0.050	0.025
Beryllium (ug/l)	2	1
T-Cadmium (ug/l)	12000	32
Calcium (mg/l)	150	250
Chloride (mg/l)	40.0	150.0
T-Chromium (ug/l)	< 30.0	< 30.0
Cobalt (ug/l)	< 20	< 20
T-Copper (ug/l)	< 20.0	< 20.0
Cyanide (mg/l)	< 0.02	< 0.02
T-Iron (mg/l)	5.800	0.860
T-Lead (ug/l)	< 5.0	< 5.0
Magnesium (mg/l)	39	35
T-Manganese (ug/l)	560.0	980.0
Mercury (ug/l)	< 0.2	< 0.2
Potassium (mg/l)	2	5
T-Selenium (ug/l)	< 0.5	< 0.5
T-Silver (ug/l)	< 2.0	< 2.0
Sodium (mg/l)	14	53
Sulfate (mg/l)	330	550
T-Zinc (ug/l)	450.0	3500.0

DR=Drain

*SIL-CW-II*

Silver Creek Tailings, Park City, Utah  
Sample Date: 11/30/87

Ground Water Samples

Parameter	MW1	MW1D	MW12	MW4	MW2	MW3	MW8	MW5	MW6	MW7	MW11	MW9	MW10	MW9D
Tot. Alk. (mg/l)	137	114	119	104	121	154	57	80	57	59	200	218	223	216
Aluminum (ug/l)	<400	<400	<400	<400	<400	<400	<400	<400	<400	<400	<400	<400	<400	<400
T-Arsenic (ug/l)	<1.1	<1.1	2.5	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	5.0	13.0	5.0
T-Barium (mg/l)	0.094	0.07	0.06	0.04	0.055	0.07	0.021	0.045	0.022	0.02	0.037	0.05	0.091	0.049
Beryllium (ug/l)	2	1	<1	2	<1	1	<1	1	<1	2	<1	<1	<1	<1
Bicarbonate (mg/l)	168	140	146	128	148	188	70	98	70	72	244	266	272	263
T-Cadmium (ug/l)	175	75	4	3	80	35	12	35	355	8	<1	<5	3	5
Calcium (mg/l)	340	260	72	240	230	170	200	190	240	260	220	210	130	210
Carbonate (mg/l)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chloride (mg/l)	884.9	450	83.9	130	362.4	299.9	132	105	130	110	170	135	96.9	138
T-Chromium (ug/l)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Cobalt (ug/l)	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
T-Copper (ug/l)	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0
Cyanide (mg/l)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
T-Iron (mg/l)	0.95	0.051	<0.02	0.12	0.033	<0.02	<0.02	0.086	1.5	0.044	<0.02	0.26	0.021	0.25
T-Lead (ug/l)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	15.0	<5.0
Magnesium (mg/l)	63	52	20	39	46	34	26	34	32	31	38	33	39	33
T-Manganese(ug/l)	90.0	75	8.0	1800.0	30.0	6.0	430.0	260.0	280.0	68.0	240.0	1500.0	420.0	1600.0
Mercury (ug/l)	<0.2	<0.2	0.3	<0.2	0.2	<0.2	0.25	0.2	<0.2	0.2	0.37	0.2	0.2	0.2
T-Nickel (ug/l)	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0	10.0	<10.0	10.0	15.0	<10.0	<10.0	<10.0	<10.0
Potassium (mg/l)	3	2	<1	6	2	2	6	3	4	6	2	3	2	3
T-Selenium (ug/l)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
T-Silver (ug/l)	2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Sodium (mg/l)	280	88	10	51	54	110	44	48	40	51	35	60	41	60
Sulfate (mg/l)	270	270	84	540	210	200	430	470	540	640	300	340	190	330
T-Zinc (ug/l)	69.0	<20.0	<20.0	640.0	41.0	<20.0	2700.0	930.0	1400.0	2400.0	<20.0	<20.0	680.0	<20.0

NOTE: MW9D is a Duplicate Sample for MW9

BSHW/5582U/1

Silver Creek Tailings, Park City, Utah  
 Sample Date: 11/30/87

Drain Samples

Parameter	DR1	DR2	DR3	DR4	DR5
Tot. Alk. (mg/l)	104	313	3	-	-
Aluminum (ug/l)	<400	<400	<400	<400	<400
T-Arsenic (ug/l)	5.5	7.5	<0.5	8.0	<1.1
T-Barium (mg/l)	0.021	0.069	<0.005	<0.005	<0.005
Beryllium (ug/l)	<1	<1	<1	9	<1
Bicarbonate (mg/l)	128	382	4	-	-
T-Cadmium (ug/l)	15	1	<1	3	<1
Calcium (mg/l)	240	240	<1	-	-
Carbonate (mg/l)	0	0	0	-	-
Chloride (mg/l)	156	172.5	<1	-	-
T-Chromium (ug/l)	<5.0	<5.0	<5.0	10.0	<5.0
Cobalt (ug/l)	<20	<20	24	<20	<20
T-Copper (ug/l)	<20.0	<20.0	<20.0	<20.0	<20.0
Cyanide (mg/l)	<0.02	<0.02	<0.02	-	-
T-Iron (mg/l)	0.29	6.1	<0.02	<0.02	<0.02
T-Lead (ug/l)	<5.0	<5.0	<5.0	10.0	<5.0
Magnesium (mg/l)	32	47	<1	-	-
T-Manganese(ug/l)	630.0	2000.0	<5.0	9.0	<5.0
Mercury (ug/l)	<0.2	<0.2	<0.2	0.3	<0.2
T-Nickel (ug/l)	10.0	<10.0	<10.0	10.0	<10.0
Potassium (mg/l)	4	3	<1	-	-
T-Selenium (ug/l)	<0.5	<0.5	<0.5	4.0	<0.5
T-Silver (ug/l)	<2.0	<2.0	<2.0	<2.0	<2.0
Sodium (mg/l)	51	44	<1	-	-
Sulfate (mg/l)	500	270	1	-	-
T-Zinc (ug/l)	2700.0	240.0	<20.0	<30.0	<20.0

NOTE: DR3 is a Rinsate Blank Sample  
 DR4 is a Performance Evaluation Sample  
 DR5 is a Field Blank Sample

BSHW/5582U/2

SHL-GW-III

Silver Creek Tailings, Park City, Utah  
Sample Date: 2/24/88

Ground Water Samples

Parameter	MW1D	MW12	MW4	MW2	MW3	MW8	MW5	MW5D	MW6	MW7	MW7D	MW11	MW11D	MW11D2	MW9	MW10	MW13	MW14
Tot. Alk. (mg/l)	113	117	97	121	155	59	104	114	56	56	119	177	170	171	196	203	689	534
Aluminum (ug/l)	<200	<200	<200	<200	<200	<200	460	<200	<200	<200	<200	<200	<200	<200	<200	780	<200	
T-Arsenic (ug/l)	<1	2	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	1	2	11	<1	<1	
T-Barium (mg/l)	0.063	0.059	0.043	0.054	0.071	0.017	0.031	0.082	0.026	0.016	0.035	0.029	0.052	0.052	0.035	0.075	0.072	0.087
Beryllium (ug/l)	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
T-Cadmium (ug/l)	<1	1	2	<1	<1	14	<1	<1	6	8	<1	<1	<1	<1	2	<1	<1	
Calcium (mg/l)	260	73	230	240	160	190	210	110	220	240	44	180	92	86	170	120	270	220
Chloride (mg/l)	499.9	37	262.4	359.9	309.9	135	90	34.9	127	120	12	178	38.9	38	151	101	12	53.9
T-Chromium (ug/l)	<5	<5	<5	<5	<5	14	<5	<5	<5	<5	<5	<5	<5	<5	<5	100	125	
Cobalt (ug/l)	<20	<20	<20	<20	<20	<5	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	
T-Copper (ug/l)	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	23	<20	<20	<20	<20	<20	
Cyanide (mg/l)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	
T-Iron (mg/l)	<0.02	0.028	0.091	0.025	0.027	0.022	0.02	0.26	<0.02	0.13	0.065	0.12	0.99	0.026	0.61	0.028	<0.02	0.026
T-Lead (ug/l)	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	15	<5	<5	
Magnesium (mg/l)	48	19	40	43	31	27	37	27	29	29	12	37	24	24	30	35	<1	<1
T-Manganese(ug/l)	16	<5	2700	64	7	110	100	470	85	32	160	140	480	470	850	380	<5	<5
Mercury (ug/l)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.25	8.3	<0.2	<0.2	<0.2	<0.2	0.3	14.9	<0.2	<0.2
T-Nickel (ug/l)	<10	<10	10	<10	<10	<10	<10	<10	<10	15	<10	<10	<10	<10	<10	<10	<10	
Potassium (mg/l)	2	1	7	2	2	6	2	2	4	5	1	2	1	2	2	2	5	6
T-Selenium (ug/l)	<5	<0.5	<0.5	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.05
T-Silver (ug/l)	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	
Sodium (mg/l)	88	10	80	50	110	39	40	16	38	51	12	28	16	15	50	35	14	32
Sulfate (mg/l)	250	94	450	200	180	410	500	250	500	590	45	250	130	130	270	160	12	63
*T-Zinc (ug/l)	44	71	400	89	52	2100	97	59	1100	2100	42	47	39	29	51	610	60	66

NOTE: MW11D2 IS A DUPLICATE SAMPLE FOR MW11D  
MW5 WAS ANALYZED FOR VOLATILE ORGANICS BUT NONE FOUND

BSHW/5582U/3

Silver Creek Tailings, Park City, Utah  
Sample Date: 2/24/88

Drain Samples

Parameter	DR1	DR2	DR3
Tot. Alk. (mg/l)	114	2.0	0
Aluminum (ug/l)	<200	<200	<200
T-Arsenic (ug/l)	7	<1	10
T-Barium (mg/l)	0.022	<0.005	<5
Beryllium (ug/l)	<1	<1	10
T-Cadmium (ug/l)	8	<1	2
Calcium (mg/l)	210	<1	2
Chloride (mg/l)	190	<1	2
T-Chromium (ug/l)	<5	<5	10
Cobalt (ug/l)	<20	<20	<20
T-Copper (ug/l)	<20	<20	<20
Cyanide (mg/l)	<0.02	<0.02	-
T-Iron (mg/l)	0.48	0.41	<20
T-Lead (ug/l)	<5	<5	<5
Magnesium (mg/l)	30	<1	<1
T-Manganese(ug/l)	840	<5	9
Mercury (ug/l)	<0.2	<0.25	<0.55
T-Nickel (ug/l)	<10	<10	10
Potassium (mg/l)	4	<1	<1
T-Selenium (ug/l)	0.5	<0.5	3
T-Silver (ug/l)	<2	<2	<2
Sodium (mg/l)	73	<1	<1
Sulfate (mg/l)	400	<1	1
T-Zinc (ug/l)	1900	42	53

NOTE: DR2 IS A RINSEATE BLANK SAMPLE  
DR3 IS A PERFORMANCE EVALUATION SAMPLE

BLIND SPIKE SOLUTION PREPARED AS A  
COMPARABILITY STANDARD FOR CASE  
THE THIRD ROUND OF WATER SAMPLING  
AT PARK CITY, UTAH

RECEIVED  
MAY 3 1986  
Utah Dept. of Health  
Bureau of Solid & Hazardous Waste

PARAMETER	TRUE VALUE	AVERAGE	95% CONFIDENCE INTERVAL
Aluminum	50	52.26	42.3-62.3
Arsenic	10	9.92	7.72-12.1
Beryllium	10	9.89	8.61-11.2
Cadmium	2.5	2.38	1.99-2.77
Cobalt	10	9.90	8.55-11.3
Chromium	10	9.81	7.77-11.8
Copper	10	10.02	8.78-11.3
Iron	10	10.09	8.33-11.9
Mercury	.5	.490	.338-.642
Manganese	10	9.92	8.76-11.1
Nickel	10	9.99	8.41-11.6
Lead	10	9.96	8.28-11.6
Selenium	2.5	2.31	1.50-3.12
Vanadium	25	25.6	21.3-29.9
Zinc	10	10.07	8.59-11.5

-- All values are expressed as  $\mu\text{g/l}$ .

*SHL - GW - IV*

Silver Creek Tailings, Park City, Utah  
Sample Date: 4/11/88

Ground Water Samples

Parameter	MW1S	MW1D	MW12	MW2	MW3	MW8	MW4	MW5	MW5D	MW7	MW7D	MW6	MW9	MW10	MW11	MW11D
Tot. Alk. (mg/l)	138	113	119	121	150	56	60	63	115	58	123	55	212	227	170	170
Aluminum (ug/l)	<400	<400	<400	<400	<400	<400	<400	<400	<400	<400	<400	<400	<400	<400	<400	<400
T-Arsenic (ug/l)	<1	1.5	<1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	<1.1	2.5	14	<1	<1
T-Barium (mg/l)	0.1	.065	0.06	0.054	.076	.022	.022	0.032	0.067	0.014	0.046	0.022	.043	0.091	.025	0.051
Beryllium (ug/l)	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Bicarbonate (mg/l)	169	138	145	147	184	68	74	77	141	71	150	67	259	277	208	208
T-Cadmium (ug/l)	<1	<1	<1	<1	<1	22	8	50	<1	<1	<1	8	<1	7	<1	<1
Calcium (mg/l)	320	260	70	220	170	230	190	180	110	230	43	230	220	150	190	89
Carbonate (mg/l)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chloride (mg/l)	899.9	534.9	39.5	364.9	349.9	171	153	130	31.9	120	12.3	138	227.5	115	187.5	39
T-Chromium (ug/l)	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Cobalt (ug/l)	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
T-Copper (ug/l)	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Cyanide (mg/l)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
T-Iron (mg/l)	<0.02	<0.02	<0.02	<0.02	0.17	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	.026	<0.02	0.95	<0.02	<0.02
T-Lead (ug/l)	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	20	<5	<5
Magnesium (mg/l)	55	49	20	42	32	30	33	32	26	28	11	30	37	41	34	24
T-Manganese(ug/l)	22	12	<5	<5	13	120	46	44	86	11	420	57	1100	1200	120	250
Mercury (ug/l)	0.23	0.23	<0.2	2.6	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.023	<0.2	<0.2
T-Nickel (ug/l)	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Potassium (mg/l)	3	2	<1	2	2	6	7	4	1	5	<1	4	2	2	2	1
T-Selenium (ug/l)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
T-Silver (ug/l)	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Sodium (mg/l)	270	87	10	49	110	49	52	50	15	49	11	40	66	43	28	16
Sulfate (mg/l)	240	240	90	210	180	520	470	460	240	580	44	530	330	250	240	130
T-Zinc (ug/l)	<20	<20	<20	<20	26	2900	2400	1900	<20	2100	<20	1600	<20	1800	<20	<20

BSHW/5582U/5

Silver Creek Tailings, Park City, Utah  
 Sample Date: 4/11/88

Parameter	MW1A	MW1B	MW1C	MW11B	MW11D1	DR1
Tot. Alk. (mg/l)	1.0	3.0	1.0	3.0	169	91
Aluminum (ug/l)	<400	<400	410	<400	<400	<400
T-Arsenic (ug/l)	7.5	<1	99.5	<1	<1	<1
T-Barium (mg/l)	<.005	<.005	<.005	<.005	.053	.018
Beryllium (ug/l)	10	<1	99	<1	<1	<1
Bicarbonate (mg/l)	2	4	2	3	206	111
T-Cadmium (ug/l)	2	<1	22	<1	<1	19
Calcium (mg/l)	<1	<1	<1	<1	90	250
Carbonate (mg/l)	0	0	0	0	0	0
Chloride (mg/l)	<1	<1	11	2.5	40.5	172.5
T-Chromium (ug/l)	10	<5	100	<5	<5	<5
Cobalt (ug/l)	<20	<20	98	<20	<20	<20
T-Copper (ug/l)	<20	<20	89	<20	<20	<20
Cyanide (mg/l)	<0.02	<0.02	-	<0.02	<0.02	<0.02
T-Iron (mg/l)	<0.02	<0.02	0.1	<0.02	<0.02	<0.12
T-Lead (ug/l)	10	<5	105	<5	<5	<5
Magnesium (mg/l)	<1	<1	<1	<1	24	33
T-Manganese(ug/l)	9	<5	89	<5	260	530
Mercury (ug/l)	0.41	<0.2	4.8	<0.2	<0.2	<0.2
T-Nickel (ug/l)	<10	<10	100	<10	<10	<10
Potassium (mg/l)	<1	<1	<1	<1	1	4
T-Selenium (ug/l)	<0.5	<0.5	21	<0.5	<0.5	<0.5
T-Silver (ug/l)	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Sodium (mg/l)	<1	<1	<1	1	16	52
Sulfate (mg/l)	<1	<1	<1	1	130	510
T-Zinc (ug/l)	<20	<20	180	<20	<20	2800

NOTE: MW1A is a Performance Evaluation Sample (Lower Range)  
 MW1C is a Performance Evaluation Sample (Higher Range)  
 MW1B is a Field Blank Sample  
 MW11B is a Rinsate Blank Sample

MW11D1 IS A DUPLICATE SAMPLE FOR MW11D

BSHW/5582U/6

BLIND SPIKE SOLUTION PREPARED AS A  
COMPARABILITY STANDARD FOR CASE  
THE FOURTH ROUND OF WATER SAMPLING  
AT PARK CITY, UTAH

PARAMETER	TRUE VALUE	AVERAGE	95% CONFIDENCE INTERVAL
Aluminum (low)	50	52.26	42.3-62.3
Aluminum (high)	500	506.0	427-585
Arsenic (low)	10	9.92	7.72-12.1
Arsenic (high)	100	99.2	80.0-118
Beryllium (low)	10	9.89	8.61-11.2
Beryllium (high)	100	99.4	88.7-110
Cadmium (low)	2.5	2.38	1.99-2.77
Cadmium (high)	25	24.4	21.2-27.7
Cobalt (low)	10	9.90	8.55-11.3
Cobalt (high)	100	99.5	86.8-112
Chromium (low)	10	9.81	7.77-11.8
Chromium (high)	100	99.8	84.4-115
Copper (low)	10	10.02	8.78-11.3
Copper (high)	100	99.1	89.4-109
Iron (low)	10	10.09	8.33-11.9
Iron (high)	100	100.2	82.7-118
Mercury (low)	.5	.490	.338-.642
Mercury (high)	5.0	5.05	3.85-6.25
Manganese (low)	10	9.92	8.76-11.1
Manganese (high)	100	98.8	88.4-109
Nickel (low)	10	9.99	8.41-11.6
Nickel (high)	100	100.4	88.0-113
Lead (low)	10	9.96	8.28-11.6
Lead (high)	100	100.1	85.1-115
Selenium (low)	2.5	2.31	1.50-3.12
Selenium (high)	25	22.8	17.4-28.3
Vanadium (low)	25	25.6	21.3-29.9
Vanadium (high)	250	250.90	220-282
Zinc (low)	10	10.07	8.59-11.5
Zinc (high)	100	99.8	89.0-111

-- Statistics provided by Environmental Monitoring and Support Laboratory - Cincinnati

-- U.S. EPA QC samples used were (low - Trace Metal I, 6020, WP386 and High - Trace Metal - I, 7248, WP287)

-- All values are expressed as  $\mu\text{g/l}$

-- Two spiked solutions were prepared for the fourth round of sampling as "low" and "high", both values are listed across from their respective parameter, low values on top.

SHL-SW-T

Sample Location Description

Silver Creek Tailings

Sample Number

Sample Location

87125	Silver Creek below Prospector Square
87126	Silver Creek below Wyatt Earp Drive
87127	Silver Creek at Bonanza Drive
87128	Silver Creek at Bonanza Drive
87129	Pace-Homer Ditch below Prospector Square.
87130	Pace-Homer Ditch at Park Meadows collection box

Note: 87125, 87126, 87127, 87128, 87129, and 87130 are unfiltered samples.

87125A, 87126A, 87127A, 87128A, 87129A, and 87130A are filtered samples.

87125B, 87127B, and 87129B are sediment samples.

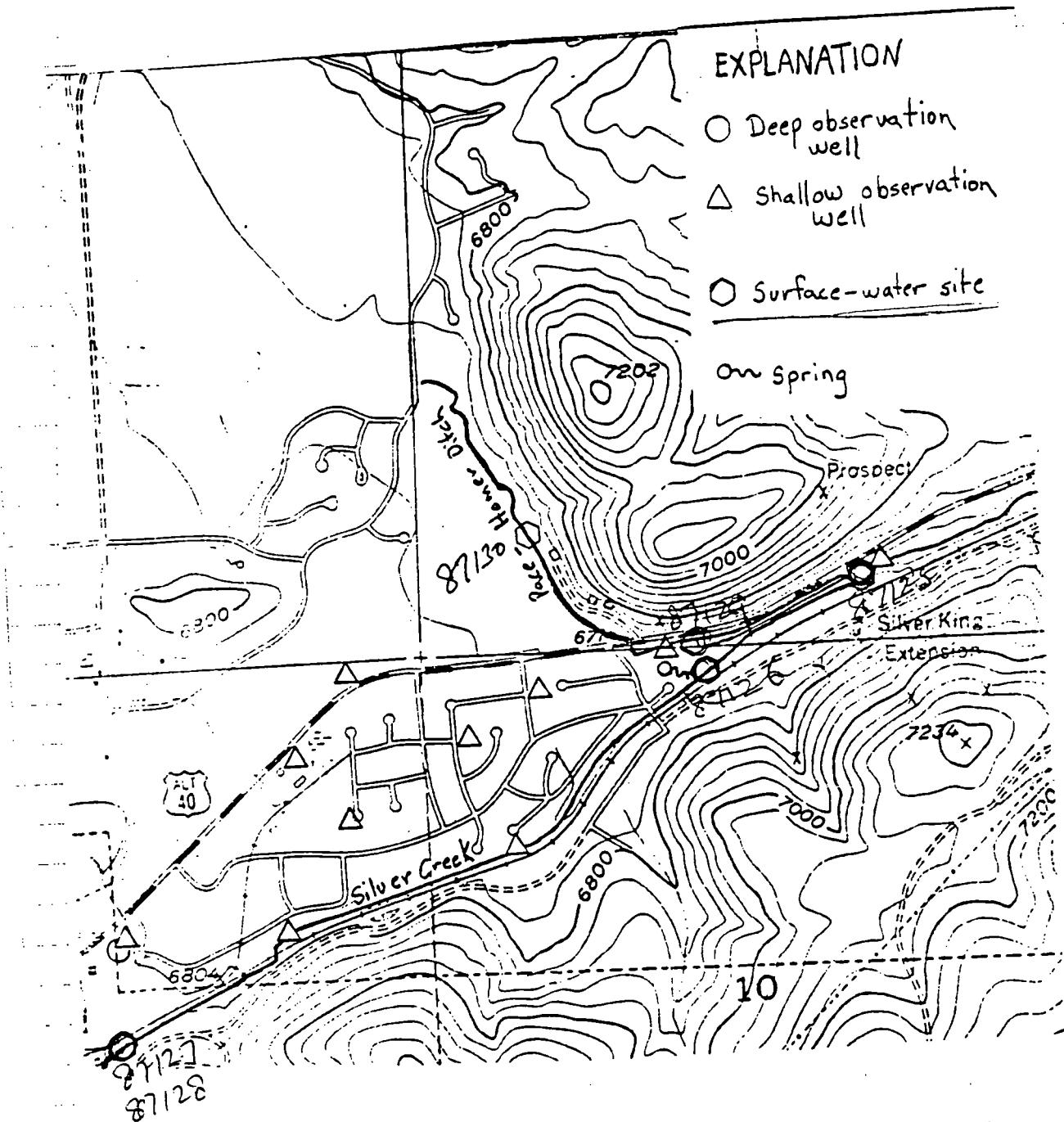


Figure 3.- Approximate locations of ground-and surface-water monitoring sites.

Table 1  
Silver Creek Tailings

Sample	Surface Water Samples						
Date: 4/29/87	(unfiltered)						
Parameter	CW87131	CW87130	CW87129	CW87128	CW87127	CW87126	CW87125
pH (no units)	5.6	8.0	8.1	8.3	8.3	8.3	7.5
Alkalinity (mg/l)	2	164	175	98	100	95	145
Conductance (umhos)	2	754	845	1022	1030	1031	1028
Calcium (mg/l)	< 1	91	100	77	77	78	120
Chloride (mg/l)	< 1.0	27.0	15.5	54.9	173	174	98.0
Cyanide (mg/l)	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02
Sulfate (mg/l)	< 1	180	170	110	110	120	210
Aluminum (ug/l)	< 200	< 200	< 200	570	580	500	< 200
T-Arsenic (ug/l)	< 1.1	10.5	7.5	18.5	18.0	14.0	10.0
T-Barium (mg/l)	< 0.005	0.051	0.025	0.090	0.091	0.080	0.044
Beryllium (ug/l)	< 1	< 1	< 1	< 1	< 1	< 1	< 1
T-Cadmium (ug/l)	< 1	< 1	< 1	6	5	4	6
T-Chromium (ug/l)	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Cobalt (ug/l)	< 20	< 20	< 20	< 20	< 20	< 20	< 20
T-Copper (ug/l)	< 20.0	< 20.0	< 20.0	40.0	38.0	31.0	< 20.0
T-Iron (mg/l)	< 0.020	0.082	0.061	1.600	1.600	1.100	0.580
T-Lead (ug/l)	< 5.0	< 5.0	30.0	640.0	700.0	430.0	165.0
Magnesium (mg/l)	< 1	31	30	16	16	16	27
T-Manganese (mg/l)	< 5.0	170.0	82.0	290.0	290.0	350.0	410.0
Mercury (ug/l)	0.15	0.25	0.75	1.40	0.75	0.55	0.65
T-Nickel (ug/l)	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Potassium (mg/l)	< 1	2	2	3	3	3	3
T-Selenium (ug/l)	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	2.0	< 0.5
T-Silver (ug/l)	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Sodium (mg/l)	< 1	17	22	96	97	NM	45
T-Zinc (ug/l)	< 15.0	31.0	62.0	860.0	870.0	560.0	780.0

Table 2  
Silver Creek Tailings

Sample	Surface Water Samples (filtered)					
Parameter	CW87131A	CW87130A	CW87129A	CW87127A	CW87126A	CW87125A
pH (no units)	9.0	8.1	7.9	8.2	8.4	7.8
Conductance (umhos)	90	745	835	1021	1055	1028
Calcium (mg/l)	8	91	100	76	83	120
Aluminum (ug/l)	210	< 200	< 200	< 200	< 200	< 200
D-Arsenic (ug/l)	45.0	12.5	5.5	5.5	4.5	5.5
D-Barium (ug/l)	< 5.0	50.0	23.0	74.0	75.0	41.0
T-Barium (ug/l)	NM	NM	NM	74.0	NM	41.0
Beryllium (ug/l)	49	< 1	< 1	< 1	< 1	< 1
D-Cadmium (ug/l)	41.0	< 1.0	< 1.0	1.0	2.0	4.0
D-Chromium (ug/l)	45.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Cobalt (ug/l)	40	< 20	< 20	< 20	< 20	< 20
D-Copper (ug/l)	47.0	< 20.0	< 20.0	< 20.0	< 20.0	< 20.0
D-Iron (mg/l)	45.0	32.0	580.0	40.0	< 20.0	< 20.0
D-Lead (ug/l)	60.0	< 5.0	5.0	10.0	10.0	10.0
Magnesium (mg/l)	< 1	31	31	15	17	27
D-Manganese (mg/l)	50.0	170.0	75.0	120.0	260.0	360.0
Mercury (ug/l)	2.34	0.20	0.25	< 0.25	0.20	0.25
D-Nickel (ug/l)	45.0	< 10.0	< 10.0	< 10.0	< 10.0	< 10.0
Potassium (mg/l)	2	2	2	3	3	2
D-Selenium (ug/l)	9.0	< 0.5	< 0.5	1.0	1.0	< 0.5
D-Silver (ug/l)	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Sodium (mg/l)	2	17	22	96	100	44
D-Zinc (ug/l)	55.0	33.0	52.0	59.0	70.0	590

Table 3  
Silver Creek Tailings

Parameter (mg/l)	Sediment Samples		
	CW87129B	CW87127B	CW87125B
% Solids	20.8	56.1	59.5
T-Arsenic	190.0	180.0	300.0
Aluminum	28000	21000	16000
T-Barium	210.0	180.0	37.0
T-Cadmium	32.0	29.0	72.0
T-Chromium	49.0	49.0	31.0
Cobalt	10.0	8.6	8.0
T-Copper	360.0	240.0	360.0
T-Iron	25000.0	22000.0	30000.0
T-Lead	3600.0	4500.0	4300.0
T-Manganese	1500.0	1400.0	1300.0
Mercury	7.0	2.5	5.5
T-Nickel	18.0	15.0	13.0
T-Selenium	< 40.0	< 13.0	< 12.0
T-Silver	26.0	21.0	31.0
T-Zinc	4500.0	4000.0	9300.0

SHL-SW-II

Table A

Surface Water Sampling Locations Description  
Silver Creek Tailings  
Park City, Utah

<u>Sample Number</u>	<u>Sample Locations</u>
CW87150	Silver Creek Below Prospector Square
CW87151	Silver Creek Below Wyatt Earp Drive
CW87152	Silver Creek at Bonanza Drive
CW87153	Silver Creek at Bonanza Drive
CW87154	Pace-Homer Ditch Below Prospector Square
CW87155	Pace-Homer Ditch at Park Meadows Collection Box

Note: 87150, 87151, 87152, 87153, 87154, and 87155 are unfiltered samples.  
87150A, 87151A, 87152A, 87153A, 87154A, and 87155A are filtered samples.  
87150B, 87151B, 87152B, 87153B, 87154B, and 87155B are sediment samples.

Table 1

Silver Creek Tailings  
Park City, Utah

Surface Water Samples -- Unfiltered  
Sample Date: 8-30-87

Samples Analyzed by:  
State Health Laboratory  
Salt Lake City, Utah

Parameter (ug/l)	CW7155	CW87154	CW87153	CW87152	CW87151	CW87150
T-Arsenic	19.0	13.0	7.5	7.0	3.5	16.0
T-Barium	23.0	31.0	52.0	51.0	62.0	47.0
T-Cadmium	<1.0	4.0	<1.0	<1.0	16.0	7.0
T-Chromium	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
T-Copper	56.0	<20.0	<20.0	<20.0	<20.0	22.0
T-Iron	85.0	57.0	120.0	110.0	72.0	79.0
T-Lead	<5.0	<5.0	20.0	10.0	<5.0	105.00
T-Manganese	83.0	33.0	12.0	13.0	2900.0	1000.0
Mercury	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
T-Selenium	<0.5	<5.0	<5.0	<5.0	<5.0	<5.0
T-Silver	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
T-Zinc	100.0	240.0	120.0	57.0	3300.0	2500.0

Table 2

Silver Creek Tailings  
Park City, Utah

Surface Water Samples -- Filtered  
Sample Date: 8-30-87

Samples Analyzed by:  
State Health Laboratory  
Salt Lake City, Utah

Parameter (ug/l)	CW7155A	CW87154A	CW87153A	CW87152A	CW87151A	CW87150A
T-Arsenic	18.5	12.5	6.0	7.0	3.2	9.5
T-Barium	22.0	30.0	51.0	51.0	62.0	49.0
T-Cadmium	<1.0	<1.0	<1.0	1.0	17.0	7.0
T-Chromium	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
T-Copper	30.0	<20.0	<20.0	<20.0	<20.0	<20.0
T-Iron	<20.0	<20.0	<20.0	<20.0	<20.0	81.0
T-Lead	<5.0	<5.0	20.0	10.0	<5.0	105.00
T-Manganese	57.0	11.0	11.0	11.0	2900.0	970.0
T-Selenium	<0.5	<5.0	<5.0	<5.0	<5.0	<5.0
T-Silver	<10.0	<10.0	<10.0	<10.0	<10.0	<10.0
T-Zinc	<15.0	26.0	<15.0	30.0	3300.0	2300.0

Table 3

Silver Creek Tailings  
Park City, UtahSediment Samples  
Sample Date: 8-30-87Samples Analyzed by:  
State Health Laboratory  
Salt Lake City, Utah

<u>Parameter</u> <u>(mg/l)</u>	<u>CW87154B</u>	<u>CW87153B</u>	<u>CW87152B</u>	<u>CW87151B</u>	<u>CW87150B</u>
% Solids	27.5	57.7	49.1	45.8	58.4
T-Arsenic	220.0	140.0	210.0	110.0	370.0
Aluminum	20000.0	12000.0	16000.0	30000.0	6300.0
T-Barium	150.0	150.0	180.0	170.0	6.7
Beryllium	1.0	1.0	1.2	1.4	0.4
T-Cadmium	43.0	29.0	34.0	24.0	83.0
T-Chromium	38.0	41.0	43.0	44.0	19.0
Cobalt	6.0	8.0	10.0	12.0	8.0
T-Copper	430.0	170.0	250.0	69.0	580.0
T-Iron	22000.0	23000.0	26000.0	24000.0	32000.0
T-Lead	4600.0	3200.0	4300.0	960.0	7700.0
T-Manganese	1100.0	1300.0	1300.0	2200.0	1700.0
Mercury	16.0	3.6	3.7	2.2	6.5
Molybdenum	<26.0	<10.0	<12.0	<16.0	<7.0
T-Nickel	<26.0	13.0	22.0	22.0	9.0
T-Selenium	<52.0	<21.0	<25.0	<32.0	15.0
T-Silver	36.0	15.0	22.0	5.3	51.0
Vanadium	51.0	47.0	49.0	55.0	18.0
T-Zinc	7400.0	4500.0	5300.0	3300.0	15000.0

*SHL-SW-II*

T A B L E 1  
Silver Creek Tailings, Park City, Utah  
SURFACE WATER SAMPLES-UNFILTERED  
Sample Date: 04/13/88

Parameter	Pace Homer at Park Meadows Collection Box	Pace Homer at Diversion	Silver Creek Below Prospector Square	Silver Creek at Wyattearp Drive	Silver Creek at Bonzana Drive
Tot. Alk. (mg/l)	186	185	152	109	10
Aluminum (ug/l)	<400	<400	<400	450	<40
T-Arsenic (ug/l)	5.5	3.5	<3.5	5.5	2
T-Barium (mg/l)	0.055	0.039	0.036	0.084	0.0
Beryllium (ug/l)	<1	<1	<1	<1	-
Bicarbonate (mg/l)	227	225	185	133	10
T-Cadmium (ug/l)	<1	<1	1	4	-
Calcium (mg/l)	86	100	110	81	-
Carbonate (mg/l)	0	0	0	0	-
Chloride (mg/l)	29.9	48	147.5	259.5	267.
T-Chromium (ug/l)	<5.0	<5.0	<5.0	<5.0	<5.0
Cobalt (ug/l)	<20	<20	<20	<20	<2
T-Copper (ug/l)	<20.0	<20.0	<20.0	<20.0	<20.
Cyanide (mg/l)	<0.02	<0.02	<0.02	<0.02	<0.0
T-Iron (mg/l)	0.083	0.057	<0.02	0.77	<0.0
T-Lead (ug/l)	<5.0	10.0	<5.0	05	-
Magnesium (mg/l)	27	28	26	17	1
T-Manganese(ug/l)	310	120	<5	310	<5
Mercury (ug/l)	<0.2	<0.2	<0.2	<0.2	<0.
T-Nickel (ug/l)	10.0	<10.0	<10.0	<10.0	<10.
Potassium (mg/l)	3	2	3	3	-
T-Selenium (ug/l)	<0.5	<0.5	4	<0.5	<0.
T-Silver (ug/l)	<2.0	<2.0	<2.0	<2.0	<2.
Sodium (mg/l)	20	22	66	130	13
Sulfate (mg/l)	140	170	180	89	8
T-Zinc (ug/l)	<20	64	100	440	6

NOTE:

BSHW/5582U/7

T A B L E 2

Silver Creek Tailings  
Park City, Utah

Surface Water Samples -- Filtered  
Sample Date: 04-13-88

Parameter	Pace Homer Park Meadows Collection Box	Pace Homer Diversion	Silver Creek BELOW Prospector Square	Silver Creek Wyattarp Drive	Silver Creek at Bonzana Drive
T-Arsenic	5.5	2.5	5.5	1.5	2.5
T-Barium	52	36	39	74	81
Beryllium	<1	<1	<1	<1	<1
T-Cadmium	<1	<1	<1	<1	<1
T-Chromium	<5	<5	<5	<5	<5
Cobalt	<20	<20	<20	<20	<20
T-Copper	<20	<20	<20	<20	<20
T-Iron	21	20	20	20	20
T-Lead	<5	<5	<5	<5	<5
Manganese	290	110	170	220	270
Mercury	<0.2	<0.2	<0.2	<0.2	<0.2
Nickel	<10	<10	<10	<10	<10
T-Selenium	<0.5	<0.5	<0.5	<0.5	<0.5
T-Silver	<2	<2	<2	<2	<2
T-Zinc	29	62	270	170	150

5582-8

T A B L E 3

Silver Creek Tailings  
Park City, UtahSediment Samples  
Sample Date 4-13-88

Parameter (mg/l)	Pace Homer at Diversion	Silver Creek BELOW Prospector Square	Silver Creek at Wyattearp Drive	Silver Creek at Bonzana Drive
%Solids	55.6	64.5	66.9	73.4
T-Arsenic	200	370	100	93
Aluminum	2000	110	29,000	1780
T-Barium	170	6	140	200
Beryllium	1.2	6.6	1.5	1.5
T-Cadmium	31	140	14	15
T-Chromium	72	30	43	75.5
Cobalt	12	8	11	6.5
T-Copper	440	1400	63	93
T-Iron	3500	30,000	29,000	2000
T-Lead	3100	12,000	380	1300
T-Manganese	1300	1900	410	1800
Mercury	6.7	3.4	0.4	1.2
T-Nickel	<20	<20	18	<20
T-Selenium	<20	<20	<20	<20
T-Silver	20	86	3	6.8
T-Zinc	4700	30,000	720	2100

NOTE: No Sediment sample was available for collection from the Pace Homer Ditch at the collection box location.